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## AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. SECTION G—BOTANY.

SECTION G of the American Association for the Advancement of Science met at New Orleans during convocation week. In the absence of the chairman, Dr. Erwin F. Smith, the meetings of the section were presided over by Professor S. M. Tracy, and by Professor B. L. Robinson, past-chairman and vice-president of the association. The vice-presidential address, by Professor Robinson, has been printed in full in this journal.

The following papers were presented:

*The Secretion of Salt by the Leaves of Spartina Stricta:* F. H. BILLINGS.

*Improvement of the Quality of Grapes:* T. V. MUNSON.

*The Preparation of Non-toxic Distilled Water:* B. E. LIVINGSTON.

*Ascidia in Fraxinus:* GEORGE H. SHULL.

Specimens, photographs and drawings were exhibited to show the occurrence of ascidia in *Fraxinus Americanus*, and this occurrence was construed as a strong support for the thesis that variations of plants and animals are narrowly limited in kind by the characters they already possess. Although this abnormality must be extremely rare in *Fraxinus*, and has never been recorded, there is a group of young trees near the station for experimental evolution on which it is a frequent occurrence. Of thirty trees taken consecutively eleven bore 103 ascidia, the other trees being entirely normal. The relation of these

abnormal leaves to the normal pitchers of *Sarracenia* and *Nepenthes*, and to the peltate leaves of many other species, was recalled, and it was shown that the relation between the pitcher and the peltate leaf rests upon the ratio between radial and tangential growth of the leaf tissue, and that this ratio fluctuates about a definite mean value for a particular position in any given species, whether the development occurs in a complete circle or in a broken circle. This ratio determines the narrowness of the ascidium, as well as many other details of leaf form, such as plications, curled and upturned edges, etc. It was observed that this ratio was apparently greater in the ascidia than in a normal leaf and it was suggested that this appearance is due to the development of a sector of leaf tissue in the place of the normal sinus, and that this sector must be taken into account when comparing the ascidium with the normal leaf. Exception was taken to the frequently expressed idea of fusion, the essential feature of the ascidium being described as due to the retention of a capacity for further radial development by certain cells in the median dorsal line, which cells normally lose this capacity at a very early stage of development. It was noted that the ascidia could be referred to two types, the more common form involving the basal margin of the leaf, the other being located within the leaf and leaving the basal margin normal. The former was called a seamless ascidium. It comprised a little over 50 per cent. of the cases, and the seamed ascidia were found in about 47 per cent. Several peculiar combinations of the two types were noted. The stalk of the seamless ascidium differs from a normal petiolule in that it is cylindrical and contains a single concentric bundle, the normal stalk containing, in addition to this, two small collateral bundles running beneath two ridges which are continuous with

the leaf margins. A strongly marked periodicity in the position of the ascidia in the leaf was found to agree closely with that found by Miss Tammes for their occurrence on the branches of *Tilia*, which fact suggests the morphological similarity of leaf and branch. This period for *Fraxinus* was as follows: Of 103 ascidia 96 were on terminal leaflets, five on the ultimate pair of lateral leaflets and two on the penultimate pair. This occurrence of ascidia on the terminal leaflets agrees with recorded observations on other species having polyphyll leaves and this fact was adduced as further evidence of orthogenesis. When the two leaves at any node spread laterally, they show a strong tendency to be symmetrical with regard to the occurrence of ascidia, but when they spread in a vertical plane, only the lower leaf bears an ascidium. The extreme localization of ascidia-bearing ash trees was presented as evidence of their recent origin at this particular spot, and the fact that a large number of individuals of various ages possess this structure was held to be strong evidence in favor of their inheritability, but both the origin and inheritance must await demonstration by pedigree-culture.

*Phytogeography of Florida:* P. H. ROLFS.

(I.) A discussion of the general conformation of Peninsular Florida giving a general outline of the topographic regions. (II.) The distribution of pine woods. Plants associated with this formation. (III.) The scrub formation and its plant association. (IV.) The mangrove formation and its associates.

*The Florida Strand:* P. H. ROLFS.

A discussion of the Florida strand showing the principal plants with effect of location on various species.

*The Everglades:* P. H. ROLFS.

A general description of the everglades

giving the plant societies and conformation of the surface.

*The Development of Armillaria mellea; The Development of Agaricus campestris:* GEO. F. ATKINSON.

These papers described the development of the sporocarps from the homogeneous condition up to the differentiation of the parts of the mature structure.

*The Behavior of the Pollen Tube in *Houstonia cærulea*:* CHESTER A. MATHEWSON.

The ovules of this plant are without integument and there is therefore no micropyle. The course of the pollen tube is analogous to that described by Lloyd for other Rubiaceæ. It follows the style as far as the basal element of the ovary partition. Here it enters the tissue of the placenta stalk, and following this it enters the placenta. It reaches the ovule through the funicle and is then directed to the egg end of the embryo sac.

*Ring Formation in Artificial Cultures:* GEORGE G. HEDGCOCK.

Further studies have been made of the formation of fruiting rings in artificial cultures on agar media of *Cephalothecium* and *Penicillium*, and the same character noted in cultures of other fungi. Cultures were grown in the dark, and in ordinary light, establishing that the type of formation studied occurs only under the influence of light. Next, cultures were grown under rays of light transmitted through solutions of orange, red, blue and green in addition to the previous conditions. Under the effect of blue rays and in the dark no rings were formed, while rings were formed under the other conditions. The rings formed consist of alternating daily masses of denser spore formation. Daily fruit rings were observed with cultures of *Mucor* and *Hormodendron*, in addition to those already reported. These rings must not be confused with those of the type de-

scribed by Milburn on certain kinds of media with *Hypocrea rufa*, since the latter were not formed daily, each occurring during a much longer period.

*Notes on the Morphology and Embryology of the Nymphaeaceæ:* MEL. T. COOK.

As a result of the recent work of Conard and others the writer has again taken up the study of this family, using Cuban material for the work. Members of the genus *Nymphaea* correspond with the writer's previous work upon this group. Members of the genus *Castalia* show some differences in that the embryo sac is not so long and the embryo has a suspensor. Members of the genera *Bracenia* and *Cabomba* correspond with *Nymphaea* in the enlargement of the embryo sac. All embryos show monocotyl characters, but some show characters similar to those of dicotyls. The Cuban species of *Castalia* show more striking dicotyl characters than our northern species.

*North American Species of Peridermium:* J. C. ARTHUR and F. D. KERN.

This paper dealt with certain fungi growing on the leaves of various coniferous trees, and sometimes on the limbs. A half dozen kinds form large swellings on the branches and trunks of pines and do much injury, not only decreasing their value for lumber, but ruining small trees in nurseries. Altogether twenty-six species are described, a number of them being new.

*Stomatal Action and Transpiration in *Fouquieria splendens* and *Verbena ciliata*:* F. E. LLOYD.

The evidence derived from the comparative study of these two types leads to the conclusion that there is no close correlation between transpiration and stomatal action. The maximum opening of stomata is reached some hours earlier than the maximum of transpiration, and, further, wide variations in the rate of transpiration may take place without any change in the size

of stomatal openings. No evidence is found for the 'temporary opening' of Fr. Darwin.

*Absorption of Atmospheric Moisture by Desert Shrubs:* V. M. SPALDING.

The prolonged period during which *Fouquieria splendens* and some other desert shrubs remained in full leaf in the summer and fall of 1905 suggested the probable connection of this fact with the unusually high relative humidity which prevailed during that period.

Experiments were carried out with twelve different species of perennials to ascertain whether they are capable of absorbing water vapor directly from the atmosphere. Leaves and other parts were accurately weighed before and after exposure to a saturated atmosphere.

The leaves of *Fouquieria* do not absorb water from the atmosphere, but the buds and branches are capable of such absorption. In the case of *Celtis pallida* and a number of other species there is no satisfactory evidence of the absorption of water vapor from the atmosphere by the living parts of the plant before pathological changes set in. Experiments with *Covillea tridentata* indicate a positive, though limited capacity for leaf absorption. Other plants vary in their deportment in this respect.

There is no evidence that the extremely small amounts of water absorbed in this way are utilized in the body of the plant, but there is every reason to conclude that high relative humidity proves to be a decided advantage to various desert plants in time of drouth by preventing excessive transpiration of the leaves and thus prolonging the period of their physiological activity.

*Correlation between Ovules and Matured Seeds in Leguminous Fruits:* J. A. HARRIS.

The paper is a study of the variability of ovules and matured seeds in the fruits of *Cercis*, *Cassia*, *Wisteria* and a garden bean. The series of constants is as yet too small to permit of any comparisons of the coefficients of regression of matured seeds on ovules with those found in inheritance, but the material promises some interesting results along this line. The regression would seem to be an obstacle to the fixing of the extremes of fluctuating variability by natural selection.

*The Structure and Cytological Changes accompanying Secretion in Nectar Glands of Vicia faba:* CHARLES R. STOCKARD.

The author finds that the nectar glands on the stipules of *Vicia faba* contain layers of cells whose contents have different chemical reactions, which fact is indicated in living material by their differences in color. This probably points to a difference in metabolic activity in the cells, since those of definite layers have similar reactions. The color response of the cells to acids and bases is the typical litmus change; acids causing the cell contents to become red, bases changing it to blue.

The nuclei are granular in structure, often coarsely vacuolated with one or more plasmosomes surrounded by vacuoles. Their shape tends toward spherical, but in old glands they become shrunken and slightly irregular in form. The position of the nucleus in the secreting cell varies greatly, but is more often near the cell center. It is never observed to give out granular material directly to the cytoplasm, though evidence is strongly in favor of the fact that it does transmit a substance to the cytoplasm which finally forms, or causes to form, granules that take in the older glands the nuclear stains. In rare cases the nucleus loses its chromatin in old glands and colors with plasma

stains, staining with the acid fuchsine of Auerbach.

The cytoplasm undergoes changes in structure as secretion progresses, first becoming vacuolar, then slightly granular, still taking plasma stains, and finally densely granular staining with the nuclear dyes. There is evidence to indicate that the cytoplasmic changes are controlled by the nucleus.

The nucleus seems to be the center of metabolic activities participating in the formation of the secretion substance, but playing a passive rôle in the actual process of secretion or extrusion of material from the cell.

The following are the titles of papers presented at a joint meeting of the section and the American Mycological Society:

*Some Reasons for Desiring a Better Classification of the Uredinales*: J. C. ARTHUR.  
*Uredineæ of the Gulf States*: S. M. TRACY.  
• *North American Gill Fungi*: F. S. EARLE.  
*Lichens and Recent Conceptions of Species*: BRUCE FINK. (By title.)

*Cultures of Colletotrichum and Glæosprium*: P. H. ROLFS.

*The Affinities of the Fungus of Lolium temulentum*: E. M. FREEMAN.

*Peridermium cerebrum Peck and Cronartium Quercum (Berkeley)*: C. L. SHEAR.

*Ramularia: An Illustration of the Present Practise in Mycological Nomenclature*: C. L. SHEAR.

*Notes on Pachyma cocos*: P. H. ROLFS.

*Penicillium glaucum on Pineapple Fruits*: P. H. ROLFS.

*The Occurrence of Fusoma parasiticum Tubuef in this Country*: PERLEY SPALDING.

*Some Peculiar Fungi New to America*: W. G. FARLOW.

FRANCIS E. LLOYD,  
Secretary.

#### SOCIETY OF AMERICAN BACTERIOLOGISTS.

THE seventh annual meeting of the Society of American Bacteriologists was held in the New Medical Building, University of Michigan, December 28 and 29, 1905.

Professor Edwin O. Jordan, president of the society, gave the introductory address on 'Variation in Bacteria.'

The following papers were presented:

*Preliminary Communication upon a Spirochætal Infection of White Rats, and Observations upon the Multiplication of the Spirochætes in Fluid Medium*: Drs. NORRIS, PAPPENHEIMER and FLOURNEY, Pathological Laboratory, Bellevue Hospital, New York.

With the blood of a case of relapsing fever, the authors were able to inoculate successfully monkeys and white rats. The following is a summary of the results obtained:

1. A subcutaneous inoculation in white rats, with blood containing spirochætes, is followed in the course of two or three days by the presence of more or less numerous spirochætes in the circulating blood. These persist from one to three days.
2. Unlike the spirochætal infection of man and monkeys, no relapses occur.
3. The rats show no obvious symptoms of illness, no local reaction, no visceral lesions of consequence, save turgescence and enlargement of the spleen.
4. In all, a series of about twenty-five generations have been kept alive through rats.
5. Observations show that immunity is conferred by previous infection. Inoculation of spirochætal blood, plus small doses of serum from animals that have gone through a previous infection, retards, or completely inhibits, the development of the spirochæte in the circulating blood of rats. Subcutaneous inoculation of serum, fol-

lowed several days later by injection of spirochetal blood, has not, in the few experiments made, prevented the development of the infection in rats.

6. There is no evidence that longitudinal division ever occurs. On the other hand, the constant occurrence of organisms showing an extreme attenuation in the central portion, as well as organisms lying end to end, with their pointed extremities in close approximation, strongly indicates transverse fission or possibly fragmentation. Long thread-like forms showing several areas of attenuation are seen at times.

7. No evidence of an enveloping or undulating membrane was seen in specimens stained by Wright's, Giemsa's, Proscia's or Loeffler's methods. Likewise no evidence of distinct cilia was obtained. The spirochaetes, therefore, more closely resemble the bacteria than protozoa.

8. In human and rat blood to which has been added sodium citrate to prevent coagulation, there can be seen within twenty-four hours after inoculation with a few drops of rat blood containing spirochaetes, a very evident increase in the number of these organisms. The spirochaetes are vastly more numerous in the smears from the culture fluid than in control smears taken at the time of inoculation, notwithstanding the dilution of infected blood with approximately thirty to fifty times its volume of medium.

By inoculating several drops of this first generation into a second blood tube, the organism was found in approximately the same numbers in the transplant. A third generation, however, failed to grow.

Multiplication apparently occurs in the undiluted citrate blood from infected rats, kept overnight at room temperature. Moreover, citrated blood, kept at room temperature for six days, retains, unimpaired, its infective properties.

*Spirochæte Obermeieri:* F. G. Novy and R. S. KNAPP, University of Michigan, Ann Arbor, Mich.

The spirochæte studied was obtained through the kindness of Dr. Norris. It has been kept alive by successive passage through white rats for over two months. As a result of intraperitoneal inoculation the parasites appear in the blood in thirty-six to forty-eight hours after inoculation and disappear within twenty-four hours, and do not reappear. The rats are then immune to subsequent inoculation. The disappearance of the spirochaetes was shown to be due to the formation of anti-bodies. Spirochetal blood when kept *in vitro* retains its virulence for more than fifteen days.

The blood of rats which have been given repeated injections of spirochetal blood exerts a most marked preventive and curative action. When injections of such blood are made, before inoculation with spirochaetes, the latter fail to appear. Similarly, when simultaneous injections of immune and spirochetal blood are made no infection results. Even when the immune blood is injected ten, twenty-five and thirty-six hours after inoculation with spirochaetes, that is to say, at any time before the spirochaetes actually appear in the blood, they will fail to appear, whereas in the controls they become numerous.

The curative action of the immune blood is equally pronounced. In rats which have from five to ten spirochaetes per field of the one-twelfth-inch objective an injection of two cubic centimeters of immune blood is followed within one hour by a total disappearance of the spirochaetes from the circulation (as actually demonstrated before the society). After this the parasites do not appear, while in the controls they persist for twenty-four hours. This remarkable curative action of immune blood in the case of the white rat will form without

doubt the basis of curative treatment in relapsing fever and in tick fever of Africa. It is the intention of the authors to work on the practical application of the principle discovered.

Spirochetal blood which has been diluted with ten parts of salicilate solution and filtered through a Berkefeld filter, under a pressure of fifty pounds, yields a filtrate which, when injected into white rats, produces typical spirochetal infection. The spirochætes, as in the case of cultures of *Trypanosoma Lewisi*, are filterable through a Berkefeld filter. Importance of this fact in its bearing upon the so-called ultra-microscopic organisms was pointed out.

All attempts thus far to cultivate the spirochæte on blood agar have failed, but this subject will be followed further. The spirochætes multiply by transverse divisions and show other characteristics which belong to bacteria. On the other hand, the transmission of spirochetal diseases by insects, the persistence of the organisms in such insect hosts for months, and the infection of the eggs of such insects, are the main facts known at present which point to a possible protozoal nature of the parasites.

The persistence of the spirochætes of tick fever in the blood of rats for three to eight days, as shown by Dutton and Todd, would indicate that this organism, though closely related, is, nevertheless, different from that studied by us. It goes to show that tick fever of Africa and the relapsing fever of Europe are due to different species of *Spirochætes*.

This paper will shortly appear in the *Journal of Infectious Diseases*.

*Mosquito Trypanosomes:* F. G. Novy, W. J. MacNeal and H. N. Torrey, University of Michigan, Ann Arbor, Mich.  
In a previous paper on bird trypano-

somes it was pointed out that these organisms grew readily in the test tube on blood agar and that the resulting forms resembled the flagellates which Schaudinn found in the gut of mosquitoes which had fed on owls infected with *Halteridium* and with *H. Ziemanni*. In other words, the position taken was that the flagellates observed in the mosquitoes did not represent stages in the life history of intracellular parasites, but were actually cultures *in vivo* of trypanosomes present in the blood of the birds used. In confirmation of this position it was desirable to show that trypanosomes could actually grow and multiply in the gut of mosquitoes and that such forms actually did correspond to those which would be obtained *in vitro*.

Accordingly, large numbers of mosquitoes were captured along the river bank and allowed to feed on perfectly clean animals, such as rats, guinea-pigs and pigeons. At varying intervals, thirty-six to seventy-two hours after feeding, the contents of the stomachs of the mosquitoes were examined in living and in stained preparations and cultures on blood agar were made at the same time. Of more than 800 mosquitoes which were examined in this way about 120, or 15 per cent., were found to have a flagellate infection of the intestinal tract. In some this was very marked; large masses of rosettes, flagella inside, completely filling the lumen of the tube.

Several distinct forms of trypanosomes were met with; the most common of these was a *Herpetomonas* (probably *Herpetomonas subulata*) and *Crithidia fasciculata*. Owing to the large numbers of bacteria usually present much difficulty was experienced in obtaining cultures of these flagellates. Eventually, however, the *Herpetomonas* was isolated in mixed culture associated with a minute coccus, while the *Crithidia* was obtained in association with

a yeast. These mixed cultures have now been grown in the laboratory for some six months. Several other cultures were obtained, but these were soon outgrown by the accompanying bacteria.

The cultural forms of these two organisms are exactly the same as that seen in the gut of the mosquito, thus confirming the view expressed that the flagellates found growing in the intestinal tube of insects represent cultural forms *in vivo*, and, as such, correspond to those obtained *in vitro*. In both conditions not only was the form and size the same, but the blepharoplast was anterior to the nucleus. The *Herpetomonas* was characterized by the presence of two diplosomes in the posterior part of the cell. These bodies were found in the parasites within the mosquitoes as well as in those grown in culture. Animals inoculated with the cultures failed to show an infection.

When mosquitoes are allowed to feed on *T. Brucei* or *T. Lewisi* these parasites may be detected in the blood in the intestine of the mosquito twenty-four hours after feeding, and even later, and rats inoculated with such stomach contents develop typical infection.

The trypanosomes which have been met with by various investigators in the stomachs of tsetse-flies, lice, leeches, etc., are distinctly 'cultural forms,' since they show the blepharoplast in a position anterior to the nucleus. This fact indicates that all such forms can be cultivated in the test tube. The *Herpetomonas* forms found in flies and mosquitoes are true cultural trypanosomes, and, without doubt, future studies will reveal the blood parasite from which they are derived. The *Crithidia* show no undulating membrane, in the ordinary trunecated form, and on account of their peculiarity for the present at least are to be considered as representing a distinct genus.

*Isolation of Trypanosomes from Accompanying Bacteria:* F. G. NOVY and R. S. KNAPP, University of Michigan, Ann Arbor, Mich.

In general, it may be said that bacteria once introduced into a culture of trypanosomes tend to outgrow and check the development of the flagellates. In exceptional instances, however, the bacteria thus introduced exert little or no interference and may be even apparently beneficial. While in the former case the trypanosomes die out, in the latter instance the mixed culture may be kept for six months or longer.

The isolation of the trypanosomes in pure form from such mixed cultures is a matter of some importance, especially when it is desired to study the pathogenic action of the flagellates. The need of some method of separation was particularly felt in connection with the study of the mosquito trypanosomes which, since they are present in the intestinal canal, are always accompanied by various bacteria and yeasts. After many ineffectual attempts the following method was successfully employed for the isolation of pure cultures of *Herpetomonas* and *Crithidia*.

By means of a small glass spatula, made by drawing out the end of a glass rod, a little of the mixed culture was spread in a series of streaks over six Petri dishes containing solidified blood agar. The Petri dish, known as the 'Kriegsministeriums-Modell 2,' made by Greiner and Friedrichs, is particularly adapted for this purpose, inasmuch as it can be sealed effectually by means of a wide rubber band. The sealed dishes are then set aside at room temperature for ten to twelve days. The last plate or two of the series will be found to show isolated colonies of trypanosomes which can be transplanted in the usual way to the test tube. This method will undoubtedly be found useful in future studies of

the flagellates found in the intestinal canal of insects and other sanguivora. The intestinal contents can be spread directly over the plates in the manner indicated.

*The Action of So-called Complementoid in Immune Serum:* W. H. MANWARING, Indiana University.

Working with goat serum, immunized against sheep corpuscles, the action of so-called complementoid was estimated quantitatively and plotted graphically. From the curves so obtained, the following conclusions are drawn:

1. Hemolytic 'complementoid,' added in increasing amounts to hemolytic serum, or to an artificial hemolytic amboceptor-complement mixture, causes, at first, a rapid increase in hemolytic power.

2. This increase soon reaches an apparent maximum, after which a further increase in 'complementoid' causes: (I.) no change, (II.) a rapid diminution in hemolytic power, or (III.) a slow increase in that power.

3. This variability in the action of 'complementoid' when used in large amounts, depends, at least in part, on the length of time the serum is heated to produce the 'complementoid.'

4. The action of 'complementoid' is so pronounced that quantitative work that does not take its presence into consideration is practically valueless. This applies to such experiments as those forming the basis for the doctrine of 'deviation of complement.'

5. It would be difficult to explain the action of 'complementoid' by means of any of the existing hypotheses regarding the action of immune serum.

6. No conclusion is yet drawn as to whether the so-called complementoid is really a degeneration product of complement, or whether it may not be a mixture of spilt-products of other serum compo-

nents, or, in part at least, certain thus-far unrecognized thermo-stable components of normal serum.

*Abnormal Cheese Troubles due to Lactose*

*Fermenting Yeasts:* H. L. RUSSELL and E. G. HASTINGS, University of Wisconsin.

The defective trouble in cheese here described is due to the presence of a milk sugar splitting yeast. This type of micro-organism grows rapidly in milk or whey, especially when the same contains a considerable amount of acid. The milk sugar is decomposed and alcohol and carbonic acid formed in abundance, as well as undesirable flavored products. The organism causing this trouble is destroyed at the temperature of 60° C. in ten minutes, but is capable of resisting the high temperature (55° C.) for thirty-five minutes, which is used in the manufacture of Swiss cheese.

This type of organism is introduced into the milk primarily through the medium of certain customs that commonly prevail in Swiss cheese factories. First, the cold process of recovering the butter fat. Whey is held over from one day to the next in order to permit the fat to rise, and this gives an opportunity for the souring process to go on, and consequently favorable conditions for the development of these yeasts.

Second, soaking the natural rennets in old sour whey and adding this rennet extract solution to the fresh milk. These processes afford ideal conditions for the growth of the yeast germ and consequently permit of the infection of the fresh milk.

Studies of the distribution of this type of organisms show them to be much more abundant in regions where Swiss cheese is made than where the American cheddar system is practised. Yeasts have not heretofore been recognized as important factors in dairy processes, except in a few cases, but where conditions of manufacture

permit of the development of lactic acid the conditions become favorable for the growth of this type of germ life.

The complete paper appeared as Bulletin No. 128 of the University of Wisconsin Agricultural Experiment Station.

*Lactic Acid Bacteria:* W. M. ESTEN, Wesleyan University.

Since the publication of the paper on 'Acid Organisms of Milk' in 1896 the investigations as outlined in that article have been continued. The extent of territory then studied was only from Ohio to Maine. Since then samples of milk have been received from nearly every section of the United States and from Canada. There is probably no class of bacteria which has caused so much confusion in regard to names and classification as the lactic acid group. Quite a number of investigators have been studying the same organisms under different names.

In the results of these investigations are found two distinct groups of lactic acid bacteria. First, the gas-forming bacteria and, second, the non-gas-forming bacteria.

The first group is of much less importance than the second. It consists of *Bacillus coli communis*, which is not very generally found in milk, and *Bacterium lactis aerogenes* with all of its varieties. This is the *Bacillus acidi lactici* of Hueppe and also of Eckles. The only difference between *B. coli* and *B. lactis aerogenes* seems to be that of motility. This group is distinctly the aerobic one. This group may be considered as a detrimental contamination to milk and its products.

The second group is the facultative anaerobic one and never produces gas in the sugar media. Their function seems to be principally the production of lactic acid. Although there may be several species of bacteria in this group, the author is of the opinion that only one species of bacterium,

with its varieties, belongs to this group or division, namely, *Bacterium lactis acidi*, using the name given to it by Leichman as being the most appropriate. In the publication of 1896 it was called *Bacillus acidi lactici* through an error, also made by Gunther, thinking it was Hueppe's *Bacillus acidi lactici*. Names given to this organism by investigators are as follows: *Streptococcus acidi lactici* (Grotenfelt), *Bacillus acidi lactici* (Gunther), *Bacterium lactis acidi* (Leichman), *Bacillus lactari* (Dinwidie), *Bacillus a* (Freudenrich), and some others. In a former publication *B. lactis acidi* I. and II. were supposed to be recognized. As the result of later investigations the No. II. should be discarded, it probably being a devitalized or degenerate form of No. I.

The characters of *B. lactis acidi* are always distinctive if grown on lactose-litmus-gelatine as a small colony scarcely more than one quarter to one half millimeter in diameter. It avoids growth on the surface almost entirely. Under mica plates it grows more robust and produces more acid. Colonies vary from dark opaque to light-colored ones with dark specks or granules in the central portion. Stumpy spines or processes may or may not be present, a character determined by the thickness and amount of moisture, in the gelatine. In sterile milk at 37° C. it curdles in from twelve to twenty-four hours, after which there is no further change. On lactose-free agar it grows but slightly and lives only a week or two on any kind of agar. The best kind of media for its growth is milk, milk-agar, lactose and dextrose bouillon.

There is probably no organism, with the exception of some soil bacteria, of more benefit to mankind, when we consider that milk which does not contain this organism is a dangerous product if kept for any length of time. Milk free from these lactic bacteria is a good medium for the growth

of all kinds of putrefactive bacteria and disease germs, while milk which contains *B. lactis acidi* soon has all other forms destroyed by the acid or the growth of the lactic bacteria, and, further, when we discover that every properly ripened lot of cream with the most desirable flavor, and every normally ripening cheese, has from 90 to 99 per cent. of this organism present.

*The Microscopic Estimate of Bacteria in Milk:* FRANCIS H. SLACK, M.D., First Assistant Bacteriologist, Boston Board of Health Laboratory.

The special apparatus used for centrifugalizing the milk samples consists of an aluminum disc and covers ten inches in diameter and five eighths inch in depth, fitted to hold twenty small glass tubes, arranged radially. These tubes hold about two cubic centimeters each and are closed at both ends with rubber stoppers.

The samples in the tubes are centrifugalized ten minutes at a speed of 2,000 to 3,000 revolutions a minute, thus collecting the whole sediment from each sample on the outer stopper.

The sediment is obtained by breaking up the cream, pouring out the milk and carefully removing the stopper with the adhering sediment, not allowing any milk to run back on the sediment to disturb it. It is then evenly smeared with a drop of sterile water over a space of 4 sq. cm. on a glass slide, dried and stained with methylene blue.

Microscopic examination shows the approximate number and morphology of bacteria present as well as the presence of pus and streptococci.

The number of bacteria found in a representative one twelfth oil immersion field bears a fairly constant relation to the 1-10,000 plate culture (grown for twenty-four hours in a saturated atmosphere at 37° C., 1 per cent. agar being used with a reaction of + 1.5).

Thus, as a rough estimate, each coccus, bacillus, diplococcus or chain in a representative one twelfth oil immersion field represents 10,000 bacteria to a cubic centimeter in the sample of milk examined.

Advantages are: rapidity of examination, accuracy, easily learned technique, lack of costly apparatus.

The writer believes the method can, in experienced hands, safely be used for certifying milk, certifying those samples in which no bacteria are found, the large number of samples which could be examined and the increased efficiency of the supervision more than compensating for a slightly greater accuracy in plate counts.

*The Quantitative Determination of Leucocytes in Milk:* ARCHIBALD R. WARD, University of California.

The determination of leucocytes in milk has been suggested by several writers as a means for the detection of dairies marketing milk from cows with inflamed udders. A series of duplicate determinations from the same sample of milk were made by the method of Doane and Buckley, of the Maryland Agricultural Experiment Station, College Park, Md., and by the method described by Dr. Stewart, of the Philadelphia Bureau of Health. The Doane-Buckley method gave more satisfactory results with duplicate determinations than did that of Dr. Stewart. The numerical results by the Doane-Buckley method varied from four to forty times higher than those obtained by the Stewart method.

*Kinds of Bacteria concerned in Souring of Milk:* P. G. HEINEMANN, University of Chicago.

All so-called lactic acid bacteria belong to two groups, the colon aerogenes group and *streptococcus* group. This arrangement is arrived at by a comparative study of culture characteristics of pathogenic, sewage, fecal and milk streptococci. The

coagulative power of pathogenic, sewage and fecal streptococci becomes equal to that of milk streptococci by repeated passages through milk. Streptococci from milk form in long chains in lactose broth, and the chains disappear upon inoculation in litmus milk, and characteristic diplococci and short chains of three to six members appear instead. Artificial lactic acid fermentations, produced by inoculation of pure cultures of lactic acid bacteria of either group or of cow feces in sterilized milk, closely resemble the natural process. Investigations lead to the following conclusions:

1. *Bacillus acidi lactici* is a myth. The ordinary bacteria producing lactic fermentation are *Bacillus aerogenes* var. *lacticus* and *Streptococcus lacticus*. The possibility of *B. coli* participating in lactic fermentation is not excluded.

2. *Streptococcus lacticus* (Kruse) agrees in morphological, cultural and coagulative properties with pathogenic, fecal and sewage streptococci.

3. Souring of milk is caused by cooperation of both groups of bacteria, and is participated in by peptonizing bacteria always present in milk.

4. Gas is produced by *B. aerogenes* var. *lacticus*, but as a rule is held in check and ultimately stopped by the presence and final ascendancy of *Streptococcus lacticus* (Kruse).

5. Acid is produced during lactic fermentation by both classes of organisms to a marked degree. *B. aerogenes* var. *lacticus* is more sensitive to the presence of acid than *Streptococcus lacticus* (Kruse). This results in the presence of *B. aerogenes* in large numbers in initial stages of fermentation, *S. lacticus* (Kruse) becoming master of the field in terminal stages.

6. Lactic acid bacteria are of intestinal origin and gain access to milk with particles of cow feces.

7. Artificial lactic acid fermentation in sterilized milk can be produced by inoculation of pure cultures of bacteria of either group or better by the two groups combined.

8. Since *Streptococcus lacticus* (Kruse) is invariably present even in fresh milk collected with good precautions, the sanitary significance of streptococci in market milk will need further investigation.

*A Note on the Indol-producing Bacteria in Milk* (preliminary communication): S. C. PRESCOTT, Massachusetts Institute of Technology.

The occurrence of indol-producing bacteria in milk suggests the possibility of some connection between these organisms and the intestinal diseases often so prevalent in children fed on raw milk, especially that received in the larger cities, where the milk may be forty-eight hours old before it reaches the consumer.

A large number of samples of fresh milk, collected from about 175 different farms, have been examined to determine if there is any numerical relation between the indol-producing bacteria and the total number present in the milk. The samples were in general about six hours old at the time of the examination. The total numbers were determined in the usual way by plating on agar (reaction + 1) and incubating at 37.5° for twenty-four hours. Dilution of 1-10,000 was employed. Indol was determined by inoculating 1/100 c.c. of milk in a tube of peptone solution, incubating three days at 37.5°, and then testing for indol by adding a minute amount of sodium nitrite and 1 c.c. of 1:1 sulphuric acid.

In all 524 samples were examined, ranging in total numbers from less than 5,000 to 121,000,000 bacteria per cubic centimeter. Of these but 38 samples exceeded 1,000,000 in total count; 132 samples, or almost exactly 25 per cent., gave strong

indol reaction; 278 samples in which the determination was carried out quantitatively showed the following relation between total numbers and occurrence of indol:

	No. Samples.	No. showing Indol.	Per Cent.
Above 1,000,000.....	13	9	70
Between 500,000 and 1,000,000.....	2	1	50
Between 100,000 and 500,000.....	34	14	41
Below 100,000.....	229	32	14
25,000 or below.....	133	17	12

*Absorbent Cotton as a Medium for Distributing Pseudomonas radicicola:* H. A. HARDING and M. J. PRUCHA, Agricultural Experiment Station, Geneva, N. Y.

Absorbent cotton wrapped in paper and tin-foil is now widely used as a means of distributing *P. radicicola*.

The large number of failures to get results with this method contrasted with the high percentage of success when the germs were shipped in soil, lead to an examination of the packages of inoculated cotton.

In these examinations the directions on the packages were followed as closely as possible except that sterile solutions were used in order to confine the resulting growth to the germs actually upon the cotton.

Repeated examinations of twenty-five separate packages of cotton gave only an occasional colony resembling *P. radicicola* and in most cases not a single suspicious colony was found.

As a check upon the accuracy of these examinations duplicate samples from six packages were examined in the laboratories of Professor F. D. Chester and Drs. C. E. Marshall, E. M. Houghton and J. G. Lipman.

An explanation of the absence of *P. radicicola* from the inoculated cotton was found in the inability of the germs to withstand the accompanying desiccation.

Two separate laboratory trials with bouillon cultures of *P. radicicola*, placed upon sterile absorbent cotton showed that all but an occasional germ died within a few days.

Under farm conditions the contamination which enters the fluid usually represses the few surviving *P. radicicola*.

The details of the work are given in the New York Agricultural Experiment Station Bulletin 270.

*The Bacteria of the Root Nodules of the Leguminosæ:* KARL F. KELLERMAN and T. D. BECKWITH, Bureau of Plant Industry, Washington, D. C.

For the present preliminary work organisms from four species of legumes have been studied: velvet bean, soy bean, garden pea and alfalfa.

Our laboratory results are summarized briefly as follows:

Beef agar (made according to formula adopted by the American Public Health Association): surface colonies, circular in outline, somewhat convex, rather wet, shining, tinged with straw color, 1 to 6 mm. in diameter. Submerged colonies, lenticular in outline, convex after reaching surface, 3.5 by 5 to 0.25 by 0.5 in diameter.

Synthetic agar, low in nitrogen (agar flour, 10 g.; magnesium sulphate, 0.2 g.; potassium phosphate (monobasic), 1 g.; cane sugar, 10 g.; filtered tap water, 1,000 c.c.): surface colonies, circular, translucent, convex, wet, shining, 1.5 to 4 mm. in diameter. Submerged colonies, lenticular, convex after reaching surface, 0.5 by 1 to 2.5 by 5.5 mm. in diameter.

Synthetic agar (same as above plus 4 g. dibasic ammonium phosphate): surface colonies, circular, somewhat convex, wet, shining, faintly tinged with cream, 1 to 5 mm. in diameter. Submerged colonies, lenticular, convex after reaching surface, 0.25 by 0.5 to 2.5 by 5 mm. in diameter.

Does not liquefy beef or synthetic gelatin; does not form indol. Aerobic; does not form nitrites or nitrates; does not form gas.

Litmus milk: with velvet bean there is apparently no change in seven days at 28° C.; after sixteen days the litmus is almost decolorized and some acid has been produced. Soy bean is similar, except the milk becomes scarcely acid, and subsequently a very slow precipitation of the casein takes place. Alfalfa, on the other hand, produces alkali very distinctly, and forms a viscous pellicle.

Potato cylinders: the velvet bean organism produces a colorless to grayish-white, even growth. The soy bean has a very spreading growth, between clay and cream buff. Alfalfa, colorless to grayish-white; the colorless areas separated from the whitish ones, giving a coagulated appearance.

*Variations in Gas Production by Bacteria-producing Soft Rot in Vegetables:* H. A. HARDING and M. J. PRUCHA, New York Agricultural Experiment Station.

During the past five years the group of organisms connected with the soft rot of vegetables has been studied jointly by the Botanical Department of the University of Vermont and the Bacteriological and Botanical Departments of the New York Agricultural Experiment Station. In this study about forty-five cultures, including six which have been described in literature as distinct species, have been studied in detail. A comparative study of their points of difference has been repeated ten times in most cases.

This group lies just on the border line of gas formation from dextrose, lactose and saccharose in Smith tubes. In all cases there is growth in the closed arm and production of acid. A majority of the cultures produce gas, ranging in amount from a small bubble to a c.c. These

determinations have been made each time in duplicate or in triplicate.

As optimum conditions are obtained an increasing number of cultures produce gas from all of these different sugars. A culture known as Vermont XLVIII, which has long been considered as a type of the class fermenting only lactose was recently induced to produce gas from dextrose at the Vermont Laboratory.

Some striking differences still remain. A culture known as 0.2e was studied in the laboratory about a year and then inoculated into a plant in the greenhouse. It there produced the typical soft rot. A culture isolated from this experimental plant was called 0.2f. The second culture agrees with the first in pathogenicity and in all other cultural characteristics except that of gas formation. While 0.2f ferments all three sugars 0.2e forms gas only from lactose and saccharose. This notwithstanding that these two cultures have now been studied together for some years.

Other similar instances have been observed but this will suffice to indicate that there are cases where a single routine test of fermentation may lead to errors in classification.

*The Employment of Glycerin as a Differentiating Medium for Certain Bacteria:* EDUARDO ANDRADE, Florida Board of Health.

It has been determined by previous investigations of the writer that the addition of glycerin to nutrient media increases the acid-producing power of some intestinal bacteria. As an indicator for this change, acid fuchsin Grüber is neutralized to the point of decolorization with caustic potash. Both inorganic and organic acids react on the indicator, changing it to red. Alkalies decolorize it and change it to a light yellow color. The indicator is extremely sensi-

tive; 0.00003 of a gram will indicate 0.001 of a gram of hydrochloric acid.

The addition of the indicator to the ordinary culture media does not influence the growth of bacteria. The delicate changes in reaction are best obtained by Dunham's peptone solution, containing six per cent. glycerin and two per cent. of the acid fuchsin. In the ordinary culture media, such as beef peptone bouillon and beef peptone gelatin and agar, the results are not delicate or constant. Their differences are probably due to the changes in the reaction in sterilization.

The dysentery group shows quite a range in acid production, as to both amount and the time it occurs:

*B. dysenteriae* Shiga, acid slight, four to five days, neutral after three weeks.

*B. dysenteriae* Kruse, acid slight, four to six days.

*B. dysenteriae* Flexner, acid slight, four to six days.

*B. dysenteriae* New Haven, considerable, four to six days.

*B. "Y"* Hiss and Russell, none, alkaline in ten days.

#### Paracolon Group.

*B. paracolon* Kurth, none, alkaline in fourteen days.

*B. paracolon* Strong, none, alkaline in fourteen days.

*B. paracolon* Badash, none, alkaline in fourteen days.

*B. paracolon* Gwynn, considerable in four days.

*B. paracolon* Miller, considerable in four days.

*B. paracolon* Buxton, considerable in four days.

*B. paracolon* Cushing, considerable in four days.

#### Hog Cholera Group.

*B. cholera suis*, none, alkaline in ten days.

*B. icteroides* Sanarelli, considerable in four days.

The study and growth of the above organisms in media containing glycerin, and the acid fuchsin indicator, shows that they, so far as acid production is concerned, arrange themselves in groups, the *Bacillus "Y"* of Hiss and Russell, *B. paracolon* Strong and Kurth, forming a distinct group.

#### Agglutination and Biological Relationship in the *Prodigiosus* Group: MARY HEFERAN, University of Chicago.

A series of organisms with cultural characteristics like those of *B. prodigiosus* were examined for agglutinative activity. This series had been under the writer's observation for five years and the biological relationship of the twenty-two different members of the group had been fairly well determined.<sup>1</sup> Agglutination tests showed:

1. A high degree of interaction among those members of the group which were classed together by the sugar fermentation test.

2. Identity of reaction of races known to have been derived from the same culture eight or ten years previously, and kept in different laboratories.

3. Agglutinative reaction among those members of the group which tend to lose the power of pigment production, including one race which produces only a soluble red pigment. No reaction was obtained in this case with *B. fluorescens liquefaciens* or *B. lactis erythrogenes*.

4. Much confusion and inequality of interaction among other members of the group closely related biologically.

The difference between agglutinogenic power and agglutinability was clearly due, in some cases, to a viscous capsular condition of the bacilli. On the other hand, readily agglutinable cultures did not possess correspondingly high agglutinogenic power.

Experiments made to determine the optimum temperature for the agglutination process showed that better results were obtained at either 0° or 55° C. than at room temperature or at 37° C. The action of convection currents in the tubes of serum dilution and bacilli at high and low temperatures was suggested as an explanation.

<sup>1</sup> *Centralbl. f. Bakter.*, 1904, 11, pp. 311, 397, 456,

It was found that the addition of one per cent. formalin to salt solution suspensions of cultures made no difference in the agglutination results, if the cultures thus formalinized were allowed to stand for some time. Freshly added formalin seemed to inhibit agglutination.

Further experiments are under way to determine more exactly the action of formalin in the agglutination process.

*Note on the Thermal Death Point of *B. dysenteriae Shiga*:* W. D. FROST and MARY W. SWENSON, University of Wisconsin.

Four different strains of *B. dysenteriae* were tested; one of the Shiga type and three of the 'Flexner-Harris' type. The method used was that suggested in the 'Procedures Recommended by the Bacteriological Committee of the American Public Health Association,' except that the reaction of the medium was 0.0 on Fuller's scale instead of 1.5+ and also in some cases only 5 c.c. of bouillon was used instead of 10 c.c. In the latter cases the 5 c.c. of bouillon after exposure was mixed with an equal amount of double-strength agar and plated. Exposures were made at temperatures ranging from 55° to 72°. It was found that the majority of the cells were killed between 55° and 60°, but that frequently a relatively small number, possibly one individual in a hundred thousand or a million, may persist at much higher temperatures, even 70°. The cause for this wide variation in resistance to heat among the different cells is apparently due not to variation in the reaction of the culture medium, for both an alkaline and an acid medium were used, nor to variations in the composition of the medium, since the same batch of medium was used throughout, but to some undetermined cause or causes.

*A Study of the Laws Governing the Resistance of *B. coli* to Heat:* STEPHEN DEM. GAGE and GRACE VAN E. STOUGHTON, Experiment Station, Lawrence, Mass.

Experiments were made in which it was determined that the great majority of the bacteria in any *B. coli* culture are destroyed by five minutes' exposure to some temperature between 50° and 60° C. A few individuals, however, in each culture will survive much higher temperatures, in some cases remaining alive after exposure to 90° C. The very close range (about 10° C.) of temperature at which the destruction of the majority of the individual bacteria occurred, as compared with the considerable range (about 35° C.) in the temperatures at which complete sterilization was effected, would indicate that the determination of this majority death point would be of more value in species identification than is the determination of the absolute thermal death point as at present employed.

Using thermal death point tests alone, this culture of *B. coli* would be included among the sporulating bacteria, although there was no morphological evidence that true spores (endospores) were produced.

Experiments were also made to determine whether, by successively selecting cultures originating from individual organisms which had survived temperatures above the majority death point and submitting these cultures to the death point tests, a race of organisms could be propagated in which the majority of the individuals would be able to resist higher temperatures than was the case with the original culture. The experiments failed not only to produce such a race, but the results indicated the tendency toward the production of a degenerate race whose majority death point remained the same as for the original culture, and whose absolute thermal death point was reduced toward the

majority death point as the number of successive generations was increased.

To be published in the *Technology Quarterly*.

*Bird Plague* (a preliminary note): J. J. KINYOUN, Glenolden, Pa.

Beginning in May, 1905, the writer examined several dead birds, received from a dealer in Washington, D. C. On examination all these presented certain definite lesions. The organs notably affected were the liver and spleen. A provisional diagnosis was first made of tubercle, but on examination it was negative. The lesions found in the liver and spleen were yellowish nodules of varying size, which projected from the surface of the organs. The majority of the nodules were surrounded with a well-marked zone of inflammatory tissue. There were also spots of coagulation necrosis interspersed between the nodules. There was also found a catarrhal exudate affecting the upper air passage. In a few instances there was enteritis. Direct microscopical examination showed a small bacillus with rounded ends and morphological and tinctorial propensities resembling *Bacillus pestis*. The organisms were present in enormous numbers in the nodules, particularly in those of the spleen. It could also be identified and easily isolated from the heart's blood and all other organs. The cultural characters are: it grows rather slightly on ordinary peptone bouillon agar, it does not liquefy gelatine, nor does it ferment any of the sugars except mannit. Grown on Hankin's salt agar it assumes pleomorphism; closely resembles the organism of bubonic plague. It grows best in peptone bouillon or agar containing a small amount of sterilized horse or calf serum. Calf serum agar containing two per cent. is coagulated. It is pathogenic to rabbits, guinea-pigs, white mice, pigeons,

sparrows, canaries, finches, mocking-birds, thrushes, parakeets. Chickens are immune.

*Notes on Class-room and Laboratory Work:*

F. C. HARRISON, Agricultural College, Guelph, Ontario.

1. Method of keeping lecture notes.
2. Material for table tops.
3. Demonstration of gas production—*(a)* with absorbent cotton, *(b)* with small tube inside test tubes, *(c)* modified Dunham tube.
4. Prevention of moisture in agar plates.
5. Method of preparing gelatine plates for demonstration and museum purposes.
6. Various forms of colony counters.
7. Method of keeping stock cultures.
8. Test-tube containers for sterilizing.
9. Flagella staining for class purposes.
10. Ink for writing on glass.

*How Shall the Potency of Antitetanic Serum be Determined?* E. M. HOUGHTON, E. C. L. MILLER and F. O. NORTHEY, Detroit, Mich.

Experience has shown that the Ehrlich test for determining the strength of anti-diphtheric serum is very reliable, and has been adopted by the U. S. Department of Public Health and Marine Hospital Service as a method of standardizing this serum. Many methods are employed for measuring the strength of antitetanic serum, but none have been generally adopted in this country. The results of laboratory tests indicate that the sera found on the market vary enormously in strength, as tested by the modified Behring method. It would seem desirable that a method be adopted for testing antitetanic serum similar to that in use for determining the strength of anti-diphtheric serum, but it seems to the writers that the test animals should be guinea-pigs and that the units of strength should be such that a curative dose of ten cubic centimeters of antitetanic serum

would contain approximately the same number of units as the curative dose of antidiphtheric serum, as recommended by the U. S. Pharmacopœia.

*A Method of Isolating the Pneumococcus in Mixed Cultures, Such as Throat Cultures:* GUSTAV F. RUEDIGER, Memorial Institute of Infectious Diseases, Chicago.

Starting with Hiss's demonstration that pneumococci ferment inulin while streptococci fail to ferment it, Ruediger has prepared a blue litmus inulin-agar medium in which the pneumococci form red colonies. This medium is composed of sugar-free agar with the addition of litmus and inulin and is prepared as follows:

(a) Peptone (Witte), 10; agar, 15; sugar-free beef broth (neutral), 1,000. Dissolve by boiling one hour, adding water from time to time. Heat in the autoclave for fifteen to twenty minutes (to prevent subsequent precipitation while sterilizing), clarify with egg and filter through cotton, making the volume up to 800 c.c. with distilled water.

(b) Dissolve 15 grams of pure inulin in 200 c.c. of boiling distilled water and add this solution to (a). Now add 20 c.c. of a five-per-cent. solution of litmus (Merck's highest purity) and tube, putting 7 to 8 c.c. of medium into each tube. Sterilize in the autoclave under ten pounds of pressure for fifteen minutes. As some pneumococci do not grow well in this medium it is necessary to add 1 c.c. of heated ascites fluid or serum to each tube of melted agar (which has been cooled to 45°) immediately before using. In this mixture the pneumococci grow well and form red colonies in twenty-four to seventy-two hours.

Ruediger has shown further that pneumococci are practically the only mouth bacteria that ferment inulin. It is not fermented by streptococci (Hiss), staphylo-

cocci, pseudodiphtheria bacilli, *Micrococcus catarrhalis*, *Micrococcus tetragenus* and *Bacillus mucosus*. Among ten cultures of diphtheria bacilli was found one which fermented inulin. Twenty-two cultures which were made from red colonies in plates that had been inoculated with material from throats of pneumonia and scarlet fever patients were studied in detail. All are Gram-positive cocci which grow chiefly in pairs on blood agar slants, but some also form chains in liquid media. All ferment inulin and all but four form green colonies in blood agar plates. Capsules could be demonstrated on more than half of the cultures.

The full paper will be published in the *Journal of Infectious Diseases*, January, 1906.

*Observations upon the Phagocytic Power of the Blood of Normal Human Beings:* JOSEPH MCFARLAND and EDWARD M. L'ENGLE, Philadelphia.

The blood of fifteen presumably normal individuals was examined by the method devised by Leichman and modified by Wright and Douglas and by ourselves. Twenty-four-hour cultures of *Staphylococcus pyogenes aureus* were used in all the experiments. We found that the phagocytic index varied from 23.125 to 4.35. In two cases in which the counts were repeated at intervals of five days there was a remarkable uniformity in one case and a distinct variation in the other. The experiments were all performed between the hours of three and five in the afternoon. All of our blood preparations were stained by Marino's method, which we have found the most satisfactory for our purposes. We also found that the number of bacteria taken up by the leucocytes varies with great regularity according to the strength of the bacterial suspension used. Hence, we have endeavored to use a uniform sus-

pension in all of our experiments. The clinical bearing of these experiments is indicated by the fact that those individuals whose phagocytic index was lowest had suffered from carbuncles or boils or become easily infected from slight causes.

*Conclusions.*—1. Leishman's method of determining the phagocytic power of the blood, as modified by Wright and Douglas and by ourselves, is a very simple method adapted to clinical application.

2. Marino's stain is most appropriate for demonstrating the leucocytes and the contained bacteria.

3. There is no uniformity in the phagocytic indices of the bloods of supposedly healthy individuals.

4. The phagocytic index of the same individual may be constant or it may vary upon different days.

5. An exceptionally low phagocytic count usually indicates a present or past predisposition to suppuration (the phagocytic index in this regard being determined by the use of *Staphylococcus pyogenes aureus*).

6. The phagocytic index may not be below the average in all cases in which there has been a tendency to suppuration.

*The Value of the Voges-Proskauer Reaction:* NORMAN MACL. HARRIS, University of Chicago.

The red coloration at times met with in fermentation tubes after testing the gas composition with KOH solution, was first described by Voges and Proskauer in 1898 as occurring in fermentation tube cultures of certain members of the hemorrhagic septicæmia group of bacteria, and the reaction was advocated by them as a test for differentiating members of this group. However, as proposed by them, the test is without value, because their observations were made on bacilli which we now clearly recognize as belonging to the hog cholera

group, not to the hemorrhagic septicæmia group.

The color reaction has since been proposed by Durham and MacConkey as a differential test whereby *B. lactis aerogenes*, *B. mucosus capsulatus* (Pfeiffer), and *B. cloacæ* and bacteria of such types may be distinguished from certain intestinal and other forms of bacteria. Howe and MacConkey likewise recommend it as possessing value in the bacteriological analysis of water.

Contrary to the views of the foregoing observers, the writer finds that the reaction occurs irregularly with such bacteria as *B. coli*, *B. lactis aerogenes*, *B. mucosus capsulatus* (var. Pfeiffer, and Friedländer), *B. cholerae suis*, *B. enteritidis*, *B. icteroides*, *B. paratyphosus* (several races), *B. proteus vulgaris*, *B. cloacæ*, *B. faecalis aligenes* and *B. typhosus* and *Streptococcus pyogenes*.

*Conclusions.*—1. By Voges and Proskauer the reaction was obtained not with any member of the hemorrhagic septicæmia group of bacteria, but with one of the hog-cholera group.

2. The writer finds that the reaction is not confined to any one particular group of bacteria, as found by Durham and MacConkey, but occurs widespread and irregularly amongst bacterial species.

3. As a differential test, the Voges-Proskauer reaction is of little value.

4. Its nature is at present unknown.

*The Protection of Cotton Stoppers during Sterilization:* W. H. MANWARING and R. A. AKIN, Indiana University.

The falling of condensation-water in the autoclave is largely prevented by a disc of thinnest sheet copper, suspended about a quarter of an inch below the top of the autoclave, by means of a threaded bolt, placed in the opening to the pressure gauge. This bolt is flattened on two sides,

so as to permit free passage of steam to and from the gauge. The stoppers of flasks are further protected by means of small beakers, inverted over the necks of the flasks, during sterilization. Test tubes are protected, in a similar way, by small pans of thinnest sheet copper, made to fit over the wire baskets containing them.

*The Production of Acid and Alkali by Bacteria:* E. O. JORDAN, University of Chicago.

Since Theobald Smith's work in 1895 it has been known that the acid reaction that develops in the broth cultures of many bacteria is produced by the action of the bacteria upon muscle-sugar. It has not been definitely recognized, however, that there are other substances besides sugar in the ordinary nutrient media which, under the influence of bacterial activity, lead to the production of a strongly acid reaction. One prominent text-book, indeed, affirms that 'the formation of free acid is possible only upon nutrient media containing sugar.' As a matter of fact, I have found the liquefaction of gelatin by bacteria or their sterile enzymes always gives rise to a marked acid reaction which may amount to as much as nine per cent. (*B. subtilis*) on the acid side of the phenolphthalein neutral point. A reaction of plus four per cent. is quite common in cultures of liquefying species. This is not surprising when it is remembered that substances like glyecoll and the amino-acids are conspicuous among the digestion products of gelatin. The simultaneous production of ammonia by bacteria tends to diminish the acidity of liquefied cultures, in some cases (e. g., *B. pyocyanus* at 20°) the acidity being nearly or quite overcome. The acidity is not confined to the liquefied area, but, as might be supposed, diffuses throughout the medium, altering the reaction of the gelatin at quite distant points. In nutrient agar,

on the other hand, the diffusion of alkaline products alters the reaction of the medium in the opposite direction. A standard reaction for culture media, therefore, is valid only as an initial reaction. Gelatin and agar, inoculated with liquefying species, begin to diverge from the start and in a short time may become totally different. Bacteria make their own reaction in broth, gelatin and agar and, useful as a standard reaction may be, it has distinct limitations.

Some writers have attempted to establish a fundamental distinction between acid and alkali production by bacteria. Thus Gotschlich in Kolle and Wassermann's 'Handbuch,' 1, p. 100, expresses himself as follows: "In general it may be said that acid production always depends upon a splitting of sugar (or similar substances, like glycerine, etc.); while alkali formation is a synthetic process and stands in intimate causal relation with the growth and increase of bacteria." Such a view would seem to be eminently artificial, since the ammonia to which an alkaline reaction is due is as truly a decomposition product of nitrogenous bodies as the amino-acids formed in the digestion of gelatin of the lactic acid in the fermentation of sugar. Both processes go on simultaneously, and the reaction of a culture medium in which bacteria are growing depends not only on the ability of the species to attack certain food substances, and on the chemical constitution of those food substances themselves, but also on the precise period of growth at which the reaction is tested.

*Experiments on the Staining Properties of Bacteria, with Special Reference to the Gram Method:* D. H. BERGEY, University of Pennsylvania.

Careful search in text-books fails to reveal definite information as to the factors concerned in the Gram method of staining. There is even confusion in different text-

books as to the properties exerted by the ingredients employed in the Gram method.

Investigation shows that the Gram reaction follows the employment of the para-rosanilin dyes, especially the violet dyes of this group, such as crystal violet, methyl violet, or mixtures of these known as gentian violet. The influence of the iodin is to form a new compound with the stained protoplasm of certain bacteria, which compound is insoluble or feebly soluble in alcohol. The alcohol serves as the decolorizing agent.

The exact difference in the chemical constitution between species of bacteria that stain positively and those that stain negatively by the Gram method is not definitely known, but the chemical constitution of the bacterial cell influences the behavior of the organism toward the Gram method.

Experiments along these lines are still in progress.

The following new members were elected:

Professor Erastus G. Smith, Beloit College, Beloit, Wis.

Doctor Hideyo Noguchi, assistant, Rockefeller Institute, New York City.

Doctor Francis H. Slack, first assistant bacteriologist, Boston Board of Health Laboratory.

Doctor Eduardo Andrade, bacteriologist, State Board of Health, Jacksonville, Fla.

Doctor Howard T. Ricketts, instructor in pathology, University of Chicago.

Doctor Gustav F. Ruediger, assistant, Memorial Institute for Infectious Diseases, Chicago, Ill.

Professor Wilfred H. Manwaring, Indiana University.

Professor Edwin G. Hastings, University of Wisconsin.

The officers for the ensuing year are:

*President*—E. F. Smith, Washington, D. C.

*Vice-President*—F. P. Gorham, Brown University.

*Secretary-Treasurer*—S. C. Prescott, Massachusetts Institute of Technology.

*Council*—E. O. Jordan, V. C. Vaughan, Simon Flexner, Joseph McFarland.

*Delegate to American Association for the Ad-*

*vancement of Science*—W. T. Sedgwick, Massachusetts Institute of Technology.

F. P. GORHAM,  
*Secretary.*

BROWN UNIVERSITY.

#### THE BOTANICAL SOCIETY OF AMERICA.

THE twelfth annual meeting of the Botanical Society of America was held at New Orleans, in affiliation with the American Association for the Advancement of Science, from the first to the fourth of January, 1906. While the attendance, as in the case of the association, was not large, the meeting was a good one, and the program which follows contained papers of unusual interest.

As officers for the year 1906 were elected, *President*, Professor F. S. Earle, Santiago de las Vegas, Cuba; *Vice-president*, Professor F. E. Clements, Lincoln, Nebr.; *Secretary*, Professor William Trelease, St. Louis, Mo.; *Treasurer*, Dr. Arthur Hollick, Bronx Park, New York City. In addition to these officers and Past-president Harper, of Madison, Wisconsin, the council was completed by the election of Professor B. L. Robinson, of Cambridge, Mass., and of Professor N. L. Britton, of Bronx Park, New York City. Professor E. A. Burt and Dr. D. T. MacDougal were appointed to represent the society on the council of the American Association for the Advancement of Science. Drs. A. F. Blakeslee and G. H. Shull were elected to associate membership.

A vote of thanks was passed for the efficient service of the retiring secretary, Dr. MacDougal.

The treasurer's report showed a balance in the treasury of \$3,201.43, of which a grant of \$150.00 was made to Dr. C. J. Chamberlain, of the University of Chicago, as an aid in a further field study of *Dioon* and in a morphological study of *Ceratozamia*, and a grant of \$100.00 to Professor J.

C. Arthur for a continuation of his study of Uredineae.

As a result of long continued conferences between committees of the Botanical Society of America, the Society for Plant Morphology and Physiology and the American Mycological Society, and in connection with similar action on the part of the other bodies named, the society adopted a new constitution by which the three societies are federated under the name The Botanical Society of America, details of the federation under the new constitution being placed in the hands of the officers.

The following papers were presented:

J. C. ARTHUR: 'Cultures of Uredineae in 1905.'

G. F. ATKINSON: 'The Development of *Ithyphalbus impudicus* (L.) Fries, from France.'

F. E. LLOYD: 'Some Physiological Aspects of Stomata.'

B. E. LIVINGSTON: 'Relative Transpiration.'

G. H. SHULL: 'Comparative Variation and Correlation in Three Mutants and their Parent.'

G. H. SHULL: 'Some Latent Characters of the White Bean.'

D. T. MACDOUGAL: 'Origin and Heredity of Bud Sports.'

D. T. MACDOUGAL: 'The Induction of Mutation by Artificial Stimulation.'

D. T. MACDOUGAL: 'New Mutants of the Evening Primrose.'

W. A. CANNON: 'Topography of the Chlorophyll-apparatus of Some Desert Plants.'

D. S. JOHNSON: 'A New Type of Embryo-sac in *Peperomia*.'

E. C. JEFFREY and ARTHUR HOLICK: 'Affinities of the Cretaceous Plant Remains referred to the Genera *Dammara* and *Brachyphyllum*.

B. J. HOWARD: 'The Tannin Cells of Persimmon.' (By invitation.)

V. M. SPALDING: 'Some Problems in Desert Botany.' (By invitation.)

An interesting feature of the meeting was the exhibition of a large number of excellent photographs of European fleshy fungi, made by Professor Atkinson by the aid of a grant made at an earlier meeting of the society.

WILLIAM TRELEASE,  
Secretary.

THE ASSOCIATION OF AMERICAN GEOGRAPHERS.

THE second annual meeting of the Association of American Geographers was held in New York City, December 26-27, 1905, under the presidency of Professor W. M. Davis, of Harvard University. The American Geographical Society generously offered the use of its house, at No. 15 West Eighty-first Street, and served luncheon to the members present on both days of the meeting. The annual dinner was held at the Hotel Endicott on the evening of December 26. It will appear from the program as given below that the several phases of geography, particularly the organic, physiographic and educational, were well represented. All the papers here named were read by their authors, and others were read by title. About forty members and invited speakers were present.

W. M. DAVIS, president's address: 'An Inductive Study of the Content of Geography.'

A. H. BROOKS: 'The Influence of Geography on the Exploration and Settlement of Alaska.'

J. WALTER FEWKES: 'The Sun's Influence on the Orientation of Hopi Pueblos.'

MARTHA KRUG GENTHE: 'Valley Towns of Connecticut.'

E. O. HOVEY: 'Geographical Notes on the Western Sierra Madre of Chihuahua.'

A. P. BRIGHAM: 'Lake Loen (Norway) Landslip of January, 1905.'

EMORY R. JOHNSON: 'Political Geography as a University Subject.'

CYRUS C. ADAMS: 'Map-making in the United States.'

CLEVELAND ABBE: 'A Modified Polar Projection Adapted to Dynamic Studies in Meteorology.'

ISAIAH BOWMAN: 'Hogarth's "The Nearer East" in Regional Geography.'

R. M. BROWN: 'Notes on the Mississippi River Floods of 1903 and of Other Years.'

HENRY G. BRYANT: 'Notes on Some Results from a Drift Cask Experiment.'

N. M. FENNEMAN: 'An Example of Flood Plains produced without Floods.'

D. W. JOHNSON: 'Map Studies for Engineering Students; the Classification of Contour Maps on a Physiographic Basis.'

WILLIAM LIBBEY: 'Physical Geography of the Jordan Valley.'

LAWRENCE MARTIN: 'Observations Along the Front of the Rocky Mountains in Montana.'

A. LAWRENCE ROTCH: 'Proofs of the Existence of the Upper Anti-trades.'

R. S. TARR and LAWRENCE MARTIN: 'Observations on the Glaciers and Glaciation of Yakutat Bay, Alaska.'

P. S. SMITH: 'Practical Exercises in Physical Geography.'

F. P. GULLIVER: 'Home Geography.'

J. RUSSELL SMITH: 'The Place of Economic Geography in Education.'

MARTHA KRUG GENTHE: 'Some Remarks on the Use of Topographic Maps in Schools.'

D. W. JOHNSON: 'Drainage Modifications in the Southeastern Appalachians.'

President W. M. Davis presented brief summaries of papers by G. C. Curtis, on 'Glacial Erosion in the New Zealand Alps,' and by E. Huntington, on 'Border Belts of the Tarim Basin, Central Asia.' Professor Davis concluded the program with a paper bearing the title, 'Physiographic Notes on South Africa.' Many of the papers were illustrated with lantern views.

The association does not sustain any regular publication. Through the courtesy of the American Geographical Society, their bulletin for February of this year will be mainly devoted to the proceedings of the meeting.

The officers elected for 1906 are as follows:

*President*—Cyrus C. Adams.

*First Vice-president*—Angelo Heilprin.

*Second Vice-president*—William Libbey.

*Secretary and Treasurer*—Albert P. Brigham.

*Councilors*—Three years, W. M. Davis; two years, J. C. Russell; one year, H. C. Cowles.

A. P. B.

#### SCIENTIFIC BOOKS.

*The Life of Reason, or the Phases of Human Progress.* By GEORGE SANTAYANA. First volume, 'Introduction and Reason in Common Sense'; second volume, 'Reason in Society.' New York, Charles Scribner's Sons. 1905.

These two volumes, to be followed by three others upon 'Reason in Art, in Religion and in Science,' afford more than the promise, they afford the potency, of the most significant contribution, made in this generation, to philosophic revision. The volumes evade labeling by any of the nicknames of philosophic schools. Since probably they do this of conscious choice, it is discourteous to attempt a labeling. In calling the view set forth *naturalistic idealism*, I shall, accordingly, be understood to wish to phrase the impression left upon my own mind, and to suggest that impression to the reader, rather than to classify the author. That reason is real, that it is a life, that its life is the significant and animating principle of all distinctively human activity, that is, of commerce, government and social intercourse; of religion, art and science as well as of philosophy; that the life of reason so expressed is one with the reflective principle in its simplest, most direct expressions in common sense, that is, in the perception of objects, the acknowledgment of persons, and the entertaining of ideas—this may well be called idealism, in the classic, if not in the modern epistemologic, sense. But equally marked is Dr. Santayana's insistence that reason is natural and empirical; that it is a direct outgrowth of natural conditions, and that it refines and perfects the nature it expresses; it is not transcendental either in its origin, its objects—the material with which it occupies itself—or in purpose.

Nature shows itself in a life of sentiency and of impulse. But some sentient moments mean more, satisfy more, and are at a deeper level, than others. The significance of such moments, persistently entertained, constitutes reason. For so entertained, they afford standards of estimation, of criticism, of construction; they become the starting-points of sustained effort to bring all experiences into harmony with themselves. Vital impulse gives moments of excellence; these excellences, grasped and held, modify vital impulse which now veers in sympathy with the judgments of past and the anticipa-

<sup>1</sup>The first two of these are now (Jan., 1906) published.<sup>12</sup>

tions of future thus instituted—just because reflection is a consciousness of relative worth, it perforce is a new attitude of will. These better moments, while they satisfy, or are agreeable, are not just pleasures; 'for a betterment in sentience would not be progress unless it were a progress in reason, and the increasing pleasure revealed some object which could please' (p. 4). Neither, of course, is reason the abstract formula of the intellectualist. It is the value of feeling consciously operative in the judging and reconstructing of experiences. In reason, the pleasures of sense are included in so far as they can be intelligently enjoyed and pursued.

In the Life of Reason, if it were brought to perfection, intelligence would be at once the universal method of practice and its continual reward (p. 5).

Again,

The Life of Reason is simply the unity given to all existence by a mind *in love with the good*.<sup>2</sup> In the higher reaches of human nature, as much as in the lower, rationality depends on distinguishing the excellent; and that distinction can be made, in the last analysis, only by an irrational impulse. As life is a better form given to force by which the universal flux is subdued to create and serve a somewhat permanent interest, so reason is a better form given to interest itself, by which it is fortified and propagated, and ultimately, perhaps, assured of satisfaction. \* \* \* Rationality \* \* \* requires a natural being to possess or to impute it. When definite interests are recognized and the values of things are estimated by that standard, action at the same time veering in harmony with that estimation, then reason has been born and a moral world has arisen (pp. 46-47).

This conception is made the basis of an appreciation of Greek philosophy, the wisest and most suggestive, though one of the briefest, known to the present writer; and of a criticism of liberalism (that is, of conventional naturalism—always a contradiction), for failing to see that meanings, values, ideas, are supremely real, are quintessentially, nat-

<sup>2</sup>The context shows that 'the good' is interpreted naturalistically and empirically. It is the persistent consciousness of one's most excellent experiences as these are standards of appraisal and of action.

ural; and of transcendentalism, for hypostatizing ideals into causes and substrates of the universe; for introducing mythology by translating meanings into underlying substances and efficient causes, and thus into physical, instead of moral realities, which have their energy and career in the aspiring and volitional life of thought which effects, and which is, human progress.

The working of this discriminative sense of excellence, and its increasing control of vital impulse, through union with it, is then traced through 'the discovery of natural objects,' 'the discovery of fellow minds,' the development of ideas, or of universals as themselves concretions, the relationship of things and ideas, and the sense in which (although consciousness is inefficient) thought practically operates, thus making a transition to the discussion of the ordinary practical life in which ends, purposes, are pursued. It is impossible to do justice to the volume, delicacy and justice of the observations herein contained, or to the pellucid, informed and pregnant style in which these observations have found their natural expression. A superficial reader, even the philosophic reader who does not think what he reads, may infer that there is a lack of system; the ordinary logical machinery is kept out of sight. But Dr. Santayana has not only swallowed logical formulæ; he has digested them. There are many books with much pretence of system and coherent argumentation that have not a fraction of the inevitableness and coherency of these chapters. In the main, Emerson's demand for a logic, so long that it may remain unspoken, is fulfilled.

Of course, disagreements, divergencies of estimation will arise. To me, for example, it seems that Dr. Santayana does scant justice to modern philosophy, to the Lockeian-Kantian movement; and that, in spite of his sympathy with and appropriation of Greek thought, Dr. Santayana's own position would be inconceivable, without this movement. One may believe (as the present writer is inclined to), that Dr. Santayana forces too far the doctrine of the inherently chaotic or maniacal character of consciousness by itself,

suggestive as is that idea, and ignored as has been the element of truth in it. One may also think that in failing to see *how* brute conflict naturally evokes thought, he underestimates the part played in the progress of mankind by the ventures and inconsistencies of just brute vital impulse, however uninformed; and that accordingly, at times, the pale cast of thought is too emphasized and the fear of individualistic assertion too acute. Again, it seems to me that he gives the indifference of facts to ideas, to purposes, too absolute a character, failing to see the full strength of the pragmatic doctrine that in a universe in which ends are developed in conception and insisted upon in action, thought must, as a part of the inherent machinery of such conception and realization, attribute indifference and disregard to the 'world of facts'—in order, that is, to free and multiply ends, and to liberate and vary the selection and use of means.

But, with whatever of criticism and qualification, those who think, as does the present writer, that the really vital problem of present philosophy is the union of naturalism and idealism, must gratefully acknowledge the extraordinary force and simplicity with which Dr. Santayana has grasped this problem, and the rich and sure way in which he has interpreted, in its light, the intricacies and depths of our common experiences. It is a work nobly conceived and adequately executed.

JOHN DEWEY.

COLUMBIA UNIVERSITY.

*Economic Geology of the United States.* By HEINRICH RIES, A.M., Ph.D., Assistant Professor of Economic Geology at Cornell University. New York, The Macmillan Company. 1905.

This book at once invites comparison with its predecessor of the same title, by the same publishers, and by an author from the faculty of the same institution. One is pleased to find that it is no revision, but an entirely new work, worthy of Dr. Ries, who has done so much good work in special reports in the field it covers. Though it contains fewer pages than Tarr's 'Economic Geology' (435 against 525), it contains quite as much matter on eco-

nomic geology, and a host of good *and illustrative* illustrations. This comes about in three ways. In the first place all general introductory geological or mineralogical matter is omitted. The reader is supposed to have acquired that. In the second place a slightly smaller type is used for less important matter. In the third place the style is condensed to the last degree.

This is not, however, at the expense of clearness, which is French. Indeed, the short crisp sentences often need qualification, which will (p. 230, l. 28) sometimes be found in an adjacent sentence or paragraph.

The author begins, inverting Tarr's order, with the lower priced but more important non-metallic substances. This is natural, as Dr. Ries's work has been mainly in this field, but it seems to the reviewer logically preferable also. He begins with the fuels. The bibliographic additions at the end of each chapter are noteworthy, giving the latest references, not cumbered up with a lot of obsolete matters, yet retaining the more important books of any age, and they enable the student, or the business man who cares, to pursue any subject farther readily and effectively. It seems to me they are decidedly preferable to a general list at the end of the volume.

From fuels he passes to building materials, and does not give a disproportionate treatment to clay, upon which he has done so much work. Indeed, he might well have let himself out a little. Thence he passes to salt, salines, gypsum (the order should logically be inverted), fertilizers, next to which soils and road materials might well have come, abrasives (here a little discussion of diamond and other drilling might have been appropriate) and water. This latter subject is handled in somewhat stepmotherly fashion, considering that at present in the work of the United States Geological Survey the Hydrographic Division is the tail that wags the dog. Evidently the author thinks that water power and irrigation are not properly handled in economic geology, or, perhaps, he thought that if once he started in he would not know where to stop. The second part, on 'Metallic Minerals and Ores,' begins with a clear and fair

condensed statement of present beliefs and theories as to the occurrence and formation of ore deposits. It is marked by good common sense. Iron, copper, gold and silver, silver-lead (a genetic group) follow roughly in the order of their importance. Then follow very brief statements regarding a host of minor metals, the sources, distribution, uses and production of which are briefly given, with valuable lists of references.

Throughout the book one can often see where one might wish more added, but there is little to correct or omit. Each teacher will naturally supplement as circumstances demand. A few comments on matters in the reviewer's province may be pardoned.

The occurrence of the copper 'beneath higher ground' is the weakest of the arguments for the rôle of descending waters and lateral secretion in the formation of the Lake Superior copper deposits. Indeed, the fact itself is rather questionable. The reviewer probably misled Dr. Ries by mentioning it first in the paper cited by him, but that was done to attract local interest to the matter. The progress of developments seems to show that the prevalence of mines on higher ground is mainly due to ease of discovery.

So, too, the reference (p. 290) to electrolytic refining of Lake Superior copper needs to be qualified. That has not been the normal method of treating these deposits of native copper, though very unfortunately, as it seems to me, western copper has been brought into the district and treated electrolytically. There are certain grades of concentrates from the Quincy and Calumet and Hecla which it pays to treat electrolytically to save the associated silver, and there has been a little copper, like the Mohawkite from the Mohawk Mine, where the amount of arsenic and nickel was enough to warrant electrolytic treatment, together with the product of the impure slags and various drippings and skimmings and oxidation products that go to the cupola. But the vast bulk of genuine lake copper has not been handled electrolytically. It reduces the toughness a little.

Recent and up to date as the book in general is, it is not recent enough to recognize the

report of the joint committee on the Lake Superior stratigraphy<sup>1</sup> and the triple division of the Huronian. Nor is the statement that the 'archean iron-bearing formations are unproductive' true so long as the Vermillion Range is left in that variously delimited group.

A word of especial commendation should be given to the illustrations. Numerous cuts and small but clear maps of distribution are inserted in the text, which is printed on unglazed paper of good quality, while the half-tones are well brought out by being generally inserted on glazed paper. This is easier on the reviewer's eyes, and probably easier on the binding than the use of glazed paper throughout as in Chamberlin and Salisbury's new 'Geology.' Comparatively few are expressly drawn for the work, but that is no criticism, for they are recent (almost all of the last ten years), clear and pertinent. In fact it is a positive favor thus to skim the cream of the various state and special reports. One could hardly ask for more, except perhaps a few diagrams of production such as are so valuable a feature of Branner's syllabus.

The proof-reading seems exceptionally clean, but a few errors of sense have been obtained, mainly from the author, and are appended.<sup>2</sup>

<sup>1</sup> *Journal of Geology*, 1905, p. 104.

<sup>2</sup> Errata: Page 15, fifth line from bottom, read (1, 3) instead of (13). Page 22, eighth line from top read 10,000,000,000 instead of 10,000,000. Page 28, twelfth line from below, read 250 instead of 150. Page 36, reference 21, read 'Coosa.' Page 38, last line, read 1863 instead of 1883. Page 72, sixth line from top, omit 'per cent.' after 20. Page 115, analysis of chalk should have 4.42 SiO<sub>2</sub>. Page 142, ninth line from top, plate reference should be placed after Alabaster on line above. Page 163, line 10 from below, insert natural before abrasive. Page 202, SiO<sub>2</sub>, of first analysis, should be 63.07 instead of .07. Page 286, line 19 from top, read '2,000 or 2,500.' Page 306, Fig. 62, pattern for Potosi limestone, is wrong in legend; the Potosi limestone is represented by upper one fourth inch of left and right end of section. Page 329, fifth line from bottom, read 'the metals.' Page 429, under Michigan, insert iron ores, 256, 261, 265. Page 434, under Texas, take out 'faller's earth,' 175.

On the whole the book may be pronounced excellent—one that every broad-minded business man should have, and that deserves the wide acceptance in the colleges that it is finding.

To be adopted as a text-book on economic geology by such an authority on that particular subject as Professor Geo. P. Merrill is enough to show that it is indeed a good one.

A. C. LANE.

*Die Riechstoffe.* By Dr. GEORG COHN. Braunschweig, F. Vieweg und Sohn. 1904. Pp. 219.

This is Section II., Group 2, Vol. VI., of Bolley-Engler's well-known 'Handbuch der chemischen Technologie,' which is now published in this separate form for the convenience of those interested in the study of the perfumes.

The book is divided into the following chapters: I., Definition of a Perfume; II., Literature; III., History of Perfumes; IV., Occurrence of Perfumes in Nature; V., Preparation of Perfumes; VI., Physical Properties of Perfumes; VII., Chemical Behavior of Perfumes; VIII., Quantitative Estimation of Perfumes; IX., Physiological Action of Perfumes; X., Use of Perfumes; Addenda, and Index.

Certain branches of organic chemistry have developed so rapidly during the past few years as to have risen almost to the rank of separate sciences. The chemistry of the dyestuffs and of the synthetic drugs, are cases in point. While the chemistry of the perfumes has not experienced so great a development as these, it has, nevertheless, reached the point where special books on the subject are necessary, and many have already been published. The history of perfumery goes back to remotest antiquity, but that of the chemistry of the perfumes is comparatively recent.

The book under review gives a concise summary of our present knowledge of the subject, including the chemical, physical and physiological properties of the various perfumes, together with their methods of preparation. The synthetical preparation of perfume substances, and the methods of obtaining per-

fumes from natural sources, particularly, are treated very fully.

All plants which yield ethereal oils are classified according to their natural families; and this list is supplemented by an alphabetical tabulation of all known ethereal oils, giving their physical constants and chemical constituents. The composition of various artificial ethereal oils, at least so far as ascertainable from the patent literature, is given in a later chapter (X.).

In the special part (included in chapter V.), 108 pages are devoted to a detailed discussion of the various perfume substances. The classification is based upon chemical structure, and includes the following groups: Hydrocarbons, alcohols, acetals, ethers, esters, lactones, aldehydes, ketones, phenols and phenolic ethers, nitro compounds, and bases. The methods of preparation and the characteristic reactions of the various groups are given.

The references to the literature throughout are numerous. The importance of the patent literature is recognized, and not only are references given to patents in the text, but there is also a separate classified list of all German patents covering methods of isolation or preparation of perfume substances. The different European factories which manufacture perfumes are also noted.

Trade statistics, however, are almost wholly lacking. Many reports have been published in recent years on the production of ethereal oils and perfume substances in various parts of the world, the consumption of flowers for this purpose, cost of same, percentage of oil yielded per pound of flowers, and so forth. A *résumé* of such data would have been interesting.

The book should prove a useful compilation for all interested in this branch of organic chemistry.

*Die ätherischen Öle nach ihren chemischen Bestandteilen unter Berücksichtigung der geschichtlichen Entwicklung.* By Dr. F. W. SEMMLER, ord. Honorarprofessor an der Universität Greifswald. Leipzig, Von Veit & Company. 1905. Erste Band; Erste Lieferung; Allgemeiner Teil. Large

8vo. Pp. 192. Price, Mk. 7.50 per Lieferung.

According to the announcement, the above work is to consist of three volumes, published in twelve separate parts, and will be completed in 1906. The first volume will contain the general part and the methane derivatives; the second, the hydrogenized cyclic compounds; and the third, the benzene derivatives, followed by a general index.

The appearance of this great work will be welcomed by all interested in the chemistry of the essential oils. The name of its author is sufficient guarantee that the work will be well and thoroughly done, for Professor Semmler's twenty years' experience in this field has made him exceptionally well qualified to undertake such a task. It is not too much to say that when complete this is destined to be the standard reference work on the subject, for, if carried out as at present planned, it will be the most extensive separate treatise extant on the chemistry of the constituents of essential oils. It is likely also to impart an added stimulus to investigations in this branch of organic chemistry, and thus produce a rich fruitage of results of both theoretical and practical value.

This first part contains the chapters on the methods by which the ethereal oils are obtained, their origin and occurrence in plants, and the general properties of their constituents, both physical and chemical. In discussing the general chemical properties of these constituents, the latter are classified according to their structure, and the following groups are taken up in this first part: (1) hydrocarbons; (2) alcohols; (3) aldehydes and ketones; (4) oxides; (5) acids and esters, and (6) phenols (in part).

The subject matter is well arranged and clearly presented. The type and paper are excellent. The work is one of such importance that it should, of course, be in every well-equipped chemical library. That it will really be completed in 1906 is not unlikely, as Professor Semmler is now hard at work in Berlin on his manuscripts and proof.

MARSTON TAYLOR BOGERT.

#### SCIENTIFIC JOURNALS AND ARTICLES.

*The American Museum Journal* for January is styled the *Crepidula Number*, the leading article, by B. E. Dahlgren, being 'The Development of a Mollusk' and intended as a guide to the series of models illustrating the development of *Crepidula fornicate*, recently placed on exhibition. Another article briefly describes 'The Collections Illustrating the Rocks and Minerals of Manhattan Island,' and it is noted that a complete list of the minerals would include about one hundred species and varieties. 'The Department of Vertebrate Paleontology Explorations of 1906' notes the discovery on the last day of a six years' search, of a specimen of *Orohippus*, and the end of the work in the famous Bone Cabin dinosaur quarry, a locality which has yielded many and very perfect specimens of these huge reptiles. We are also told of the discovery of the huge carnivorous dinosaur, nearly forty feet long, appropriately named *Tyrannosaurus rex*, the tyrant reptilian king. Many interesting notes, and a schedule of the lecture courses are included in the number.

*The Museums Journal* of Great Britain for December contains an account of the history, development and arrangement of the Hastings Museum, Victoria Institute, Worcester, by W. H. Edwards, and suggestions for 'A Zoological Theatre' to form an adjunct to a zoological garden. Among the reviews of museum publications, those of several American museums are very favorably mentioned. There are the usual numerous and interesting notes.

*The Museum News* of the Brooklyn Institute for January has a brief article on 'Educational Features of the Central Museum,' calling attention to some special features of the exhibits; there is a description of some important Roman mosaics from North Africa recently placed on exhibition and a note on a group of mountain goats just added to the collection. The leading article in the section devoted to the Children's Museum is 'The Story of a Piece of Coal.' Lectures are announced for both museums.

*The Bulletin of the College of Charleston Museum* is a comparatively recent addition to the list of publications whose object is to popularize the work of museums and keep the public informed of what is being done. The December number is mainly devoted to an article on whales and dolphins and gives a brief account of the cetacea, notes on some of the museum examples of this group and a list of books on whales. The number also contains references to the occurrence of the roseate spoonbill near Charleston. Under the direction of Mr. Rea, the curator, the Charleston Museum is being rearranged, relabeled and generally 'modernized.'

WITH the beginning of the present year, the *American Electrician* has become part of the *Electrical World and Engineer*, and the journal will be known as *The Electrical World*.

#### SOCIETIES AND ACADEMIES.

##### THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 608th meeting was held on December 2, 1905.

Mr. J. E. Burbank spoke on 'Recent Work in Atmospheric Electricity,' with exhibition of instruments of the Carnegie Institution. The fundamental problem in atmospheric electricity is the source of the earth's electric field. The recent researches of Professors Elster and Geitel, Ebert, Gerdien and others have brought four new factors into the study, namely, the rate of dissipation of the earth's so-called permanent charge into the atmosphere; the ionization of the atmosphere; the action of the radioactive emanations present in the atmosphere, and the circulation of the atmospheric electricity in the form of vertical and convection currents.

The paper was largely devoted to a description of the instruments and methods used in measuring the ionization. The dispersion apparatus of Elster and Geitel and Ebert's aspiration apparatus or ion counter were described.

A new instrument recently devised by Dr. Gerdien, of Göttingen, Germany, was then shown. This is similar to Ebert's and consists of an outer cylinder 20 cm. in diameter

through which air is drawn by means of a fan driven by hand. The inner electrode consists of a tube 1.4 cm. in diameter and 24 cm. long and is mounted on the post which carries the aluminum leaves of the electroscope. The loss in charge of this inner electrode is found for an interval of time, usually five minutes, during which air is drawn through the apparatus. From the known dimensions and electrostatic capacity of this cylinder condenser and its loss of potential we can calculate in absolute units the quantity  $\lambda$  represented by the product of the ionic charge ( $e$ ) into the number ( $n$ ) of ions per c.c. and into mean specific velocity ( $v$ ) (cms./sec. volts/cm.), and is known as the specific conductivity. The discussion of the formula showed that  $\lambda = env$  was independent of the velocity of the air current within wide limits; hence independent of wind, etc. The specific conductivity is not a constant as with metals, but varies with the ionic content of the air.

Dr. Gerdien has used this instrument to measure conductivity in balloon ascensions to a height of 5,700 meters, and from a series of such observations together with observations of potential gradient has deduced values for the intensity of the vertical currents. These currents on the earth's surface amount to about  $2.4 \times 10^{-16}$  amperes per sq. cm.; at a height of 2,500 meters  $0.8 \times 10^{-16}$ , and at 5,000 meters  $0.3 \times 10^{-16}$  amperes, per sq. cm.

This instrument can be used in dense fogs or even during rain. The author secured some results on a sea voyage from Liverpool to Boston showing that  $\lambda$  for positive charges was of the same magnitude as for negative charges. Curves were exhibited showing the values of the conductivity when passing into and through a fog bank and also during a light shower. The values of  $\lambda$  in dense fog are about one tenth to one twentieth the value in clear air, but curves for both positive and negative conductivity follow each other very closely even in very rapid changes of ionization.

Professor Ebert has reported to Dr. Bauer that the eclipse observations on August 30, 1905, made by him at Palma, Majorca, in the Mediterranean with his ion counter gave a

marked decrease in the negative ionization of the air during totality. The observations of conductivity taken with this new instrument by Mr. Bowen, a member of the Carnegie Institution party at Battle Harbor, Labrador, seventy-five miles south of totality belt, show also a marked decrease in the negative conductivity during the eclipse. The observations at Cheltenham, Md., with a similar conductivity instrument showed a fair agreement with the others, but in much less degree.

Mr. G. K. Burgess then spoke on the 'Monochromatic Radiation of Metals.' The object of the paper was to interpret the observations of Dr. Waidner and the author on the departure of platinum from black-body radiation for red, green and blue light in terms of the now better known values of the higher temperatures involved and as expressed by Wien's law in a form first suggested by Lucas. Discussion of the formulae leads to the conclusion that the reciprocals of the temperatures of a black body and any substance having the same photometric brightness are directly proportional. For platinum the ratio is about 1.03; so the temperatures obtained from a platinum optical pyrometer, without correction, would be from 6 to 9 per cent. too low. But 50 observations between  $996^{\circ}$  and  $1,988^{\circ}$  absolute, using red light, furnish constants for the formulæ, by the aid of which the nominal temperatures are corrected, the maximum difference being only  $3.5^{\circ}$ ; thus  $1,814^{\circ}$  observed is raised to  $1,989.1^{\circ}$ —a difference of only  $1.1^{\circ}$  from that given by the standard Holborn-Kurlbaum optical pyrometer. The important result follows that for many purposes a simple platinum strip may replace the elaborate experimental black-body.

Similar results were obtained with palladium. The speaker also gave a comparison of the electrical and thermal constants of several metals having high melting-points. (See Bulletin, Bureau of Standards.)

THE 609th meeting was held on December 16, 1905.

The retiring president, Mr. George W. Littlehales, of the Hydrographic Office, delivered an address on 'The Progress of Science

as Exemplified in Terrestrial Magnetism.' He gave a very clear sketch of the history of this branch of science, pointing out the phases that the problem had assumed and the specific contributions to the modern theory made by the leading magneticians.

CHARLES K. WEAD,  
*Secretary.*

#### THE CHEMICAL SOCIETY OF WASHINGTON.

THE 163d regular and the 22d annual meeting of the society was held on January 11, 1906.

Mr. Maximilian Toch, of New York, gave an illustrated lecture on 'The Trip of the Society of Chemical Industry through England.' It was thoroughly enjoyed by a large audience.

Following this the reports of the secretary and treasurer were read. The finances of the society are in good condition, and there has been a net increase of 27 in the number of members, the total now being 189, with four local associates. During 1905 there were ten scientific meetings held, besides three 'smokers.' Twenty-one papers were presented, three of them being by investigators invited to address the society.

The officers for 1906 were then voted for, with the following result:

*President*—L. M. Tolman.

*First Vice-president*—A. W. Dow.

*Second Vice-president*—Jos. S. Chamberlain.

*Secretary*—C. E. Waters.

*Treasurer*—F. P. Dewey.

*Additional Members of the Executive Committee*—E. A. Hill, E. T. Allen, G. H. Failyer and A. Seidell.

The congratulations of the society were extended to Dr. W. F. Hillebrand on account of his election as president of the American Chemical Society.

C. E. WATERS,  
*Secretary.*

#### THE OREGON STATE ACADEMY OF SCIENCES.

PAPERS have been presented before the Oregon State Academy of Sciences, meeting in Portland, as follows:

May 20—'The Precipitation of Barium Bromide by Hydrobromic Acid,' Professor N. C. Thorne,

Portland Academy. 'Curing and Mounting Wild Flowers,' Dr. M. A. Flinn, Portland.

June 17—'Agriculture in the Philippines,' Professor F. Lamson-Scribner, Washington, D. C.

August 19—'Mammals of Oregon,' Dr. Marcus W. Lyon, Jr., Washington, D. C. 'The Development of the Ovule and Pollen Tube in the Oregon Grape,' Elda R. Walker, University of Nebraska.

September 16—'The Forests of Oregon,' Mr. Edmund P. Sheldon, Portland.

October 21—'Science and the Farm,' Dr. J. R. Withycombe, director of the Oregon Agricultural Experiment Station, Corvallis. 'Some Insect and Fungous Diseases of Fruits,' Professor A. B. Cordley, State College of Agriculture and Mechanic Arts.

November 18—'The Indians and their Care of the Forests,' Dr. Harry E. Lane, Portland. 'Pre-localization in the Egg and Correlated Development,' Professor G. E. Coghill, Pacific University.

The academy has endorsed a plan for beginning a natural history survey of Oregon by formulating check lists of all the museum collections in the state, and of all recorded collections from the state. It is the purpose of the academy to follow these check lists with monographs on various groups as circumstances permit.

Action has been taken to secure permanent rooms for the academy in Portland. It is expected that adequate quarters will be provided for the library of the academy and for a museum which the academy hopes to acquire as time goes on. The private herbarium of Mr. Edmund P. Sheldon, president of the academy, has been loaned by him for deposit in the academy rooms. This herbarium consists of about 10,000 specimens. It will be properly mounted and made accessible for the work of the academy.

G. E. COGHILL,  
*Corresponding Secretary.*

#### THE CLEMSON COLLEGE SCIENCE CLUB.

THE 59th regular meeting of the club was held Friday, November 17.

Dr. Calhoun gave an informal talk upon his work in the west this summer. His talk was illustrated by material which he collected for the museum of natural history in the mining regions of Colorado and Utah.

The principal paper of the evening was given by Dr. Metcalf upon 'Sanitary Conditions in South Carolina.' Dr. Metcalf gave a brief statement of the fundamental principles of sanitation and the special conditions which govern their application in South Carolina, such as subtropical climate in certain portions, rural population, and a large negro element. The conditions leading to the annual prevalence of typhoid fever were deduced from specific instances. The results of three hundred bacterial examinations of the water of a typical open well; the results of observations of the surroundings of this well and the adjacent privy and a study of the bacterial flora brought by flies into the dining room of the nearby house, were presented in outline. The speaker closed with a brief discussion of the hypothetical occurrence of forms resembling *B. coli* on the surface of the plants, and the possible bearing of this on the standard water tests. Portions of this discussion have been published in Bulletin 89, South Carolina Experiment Station and in SCIENCE, October 6, 1905.

F. H. H. CALHOUN,  
*Secretary and Treasurer.*

#### THE MISSOURI SOCIETY OF TEACHERS OF MATHEMATICS (AND SCIENCE).<sup>1</sup>

THE Missouri Society of Teachers of Mathematics (and Science) met in Jefferson City, December 27 and 28, 1905, in conjunction with the State Teachers' Association. Two afternoon sessions were held and were well attended. Mr. H. C. Harvey presided. The following papers were presented:

G. R. DEEN, Rolla: 'Maxima and Minima.'

OLIVER GLENN, Springfield: 'Laboratory Methods in Algebra Teaching.'

A. M. WILSON, St. Louis: 'The Treatment of Limits in Elementary Geometry.'

THOS. JAUDON, Kansas City: 'Some Problems of Arithmetic in the Grades.'

Round Table Discussion: 'What should be taught in Arithmetic and what omitted?' U. S. Hall, Glasgow; G. B. Longan, Kansas City; H.

<sup>1</sup> Proposed amendments to the constitution provide for the addition of the words 'and Science' to the name of the society.

H. Holmes, Kansas City; H. C. Hamey, Kirksville; E. R. Hedrick, Columbia.

At the business meeting provision was made for the submission to the members of amendments to the constitution providing for the enlargement of the society so as to include teachers of science. In future mathematics and science sections will be held in addition to the general meetings. The next meeting will be held in April or May at Columbia. A more complete report of the meeting may be found in *School Science and Mathematics*.

L. D. AMES,  
Secretary.

**DISCUSSION AND CORRESPONDENCE.**

**RELATION OF MUSEUMS TO EXPERTS.**

**TO THE EDITOR OF SCIENCE:** The letter from Dr. Holland on 'The Relations of Museums to Experts and Systematists who are Engaged in Working Up and Naming Collections,' published in SCIENCE for December 15, seems to me altogether too general and too sweeping for universal acceptance. While I agree with Dr. Holland, fully, in his idea that all material borrowed from a museum or from a collector should be promptly and scrupulously returned, I think there are many cases in which a monographer or a student of a special group is fully entitled to retain material which may be sent him for identification. We are all supposed to be working for the advancement of science—for the establishment of definite facts. If a collector happens to find material which he is incompetent to use, which he can not place and of which he can not recognize the value he should, as a true and philanthropic student, send it to some one who has the ability to use it for the help of other workers. Museum material is worthless so long as it remains unknown and unidentified, and can be made of value only when it is recognized as forming a certain link in the chain. The specialist who visits a museum is in honor bound to leave its specimens intact, but the museum maker, the collector, has no right to ask busy workers for their time and labor without some courtesy in the form of a return. In my own work I have sent hundreds of specimens to specialists for

identification and description of new species, and have never asked, or expected, that the material would be returned to me. I have also worked over many collections made by others and have not hesitated to retain such specimens as I wanted for myself. When a specialist is willing to take the time and trouble to study a collection—at my request—the smallest courtesy I can offer him is the retention of the material with which he has worked. If I do not have full confidence in him as an authority in that particular group I do not send him my unstudied material. Of course there are cases in which a collector finds a specimen which he can not place, but which he recognizes as being rare or unique, and then he is perfectly justified in submitting it to an expert and asking for its return, but such cases should not constitute a general rule.

Dr. Holland expresses the idea that all material studied should remain the permanent property of the original owner. It seems to me that a distinction should be made. When a worker in any line visits a museum, or secures the loan of material for study, he is the party favored, and can have no claim; but when a museum or a collector asks the specialist to work a lot of unrecognized material the worker is justly entitled to such reward as he may find in the retention of the specimens to which he has given his time and work.

S. M. TRACY.  
BILOXI, MISS.

**THE LETTERS K AND W IN ZOOLOGICAL NOMENCLATURE.**

**IN SCIENCE** of September 29, page 399, I referred to a practise prevalent in certain quarters, of changing the letters *k* and *w* to *c* and *v*, respectively, whenever they occur in generic and specific names of animals.<sup>1</sup> At

<sup>1</sup> I there attributed the change of *Kogia* to *Cogia* to Dr. D. G. Elliot; but I find that he did not originate it. The form *Cogia* was used years ago by Wallace (1876), Blanford (1891) and Lydekker (1891). The late Dr. W. T. Blanford had curiously little respect for the original form of names, and even went so far as to alter the name of the well-known ant-genus *Pheidole* to *Phidole*, in Col. Bingham's work on the ants of

the end of the article I suggested that if working zoologists would send me their votes for or against these proposals, I would list the names and forward them for publication. I give below a list of those voting, *all against* the changes referred to. Many of the voters added strong expressions, condemning the practise of altering names, and some wrote long and interesting letters. Not a single voice was raised in favor of the changes. It will be seen that the list, while only moderately long, includes a highly representative series of names:

FRANK C. BAKER, Chicago Academy of Sciences. [Mollusca.]

PAUL BARTSCH, assistant curator, Division of Mollusca, U. S. Nat. Museum.

C. J. S. BETHUNE, editor *Canadian Entomologist*.

PHILIP P. CALVERT, University of Pennsylvania. [Odonata.]

THOMAS L. CASEY, U. S. A. [Coleoptera, Mollusca.]

H. L. CLARK, Olivet College. [Echinoderms.]

EDWIN W. DORAN, Biological Department, James Millikin University.

E. P. FELT, state entomologist of New York.

L. S. FRIERSON, Frierson, La. [Mollusca.]

K. W. GENTHE, assistant professor of natural history, Trinity College, Hartford, Conn.

JOSEPH GRINNELL, Pasadena, Calif. [Birds.]

JUNIUS HENDERSON, curator of museum, University of Colorado. [Birds, Mollusca.]

L. O. HOWARD, chief of Bureau of Entomology, U. S. Department Agriculture.

DAVID STARR JORDAN, president of Stanford University.

J. PERCY MOORE, University of Pennsylvania. [Vermes.]

HENRY F. NACHTRIEB, professor of animal biology, University of Minnesota.

J. G. NEEDHAM, Lake Forest, Ills. [Entomology.]

OSCAR W. OESTLUND, University of Minnesota. [Aphididae.]

GEO. W. PECKHAM, Milwaukee, Wis. [Arachnida.]

MARY J. RATHBUN, U. S. Nat. Museum. [Crustacea.]

H. M. SMITH, Bureau of Fisheries, Washington.

CHAS. P. SIGERFOOS, professor of zoology, University of Minnesota.

India (which he was editing), quite without the approval of the author himself!

C. W. STILES, Public Health and Marine Hospital Service. [Helminthology.]

F. M. WEBSTER, Bureau of Entomology, U. S. Department of Agriculture.

It occurs to me that it might become a useful custom to take votes on questions of wide interest through the agency of SCIENCE; not for the purpose of enforcing rules or decisions, but in order to bring out and crystallize public opinion. When there were many votes on each side, the editor or the voters might be asked to choose one on each side to present the arguments in full.

T. D. A. C.

#### SPECIAL ARTICLES.

##### THE CLASSIFICATION OF MOSQUITOES.

RECENT authors have subdivided the Culicidae in various ways, although using mainly the same set of characters. It seems, however, that the best and most natural grouping consists in the recognition of three subfamilies, as follows:

I. ANOPHELINEÆ. Defined by the long elliptical compressed thorax; the palpi are long in both sexes; the metanotum is without hairs. The larvæ have a short sessile breathing apparatus and are surface feeders, being supplied with fan-shaped tufts on the dorsum, which serve as an attachment to the water film. A ventral brush or rudder is present on the last segment after the first stage. The larvæ live in all kinds of water, from that in hollow trees to the edges of swift streams, depending upon the species in question. They all require a comparatively extended surface, owing to their habits of surface feeding. Contains the genus *Anopheles* and its subdivisions.

II. CULICINÆ. Defined by the short rounded thorax; the palpi are generally short in the female, sometimes short in the male also; the metanotum is without hairs. The larvæ have a long breathing tube, always longer than wide, and are not surface feeders. A ventral brush or rudder is present on the last segment after the first stage. The larvæ live in permanent or temporary stagnant pools or puddles; several species are addicted to hollow trees and one lives only in water-worn holes in rocks. A few species are predaceous, feeding ex-

clusively on the larvae of other species. So far as known, all the species live free in water, although it should be noted that one genus, *Tæniorthychnus*, has defied all attempts at learning its life history by the ordinary methods of dipping in puddles.

Contains the genera *Megarhinus*, *Psorophora*, *Culex*, *Grabhamia*, *Theobaldia*, *Stegomyia*, *Verrallina*, *Aedes*, *Howardina*, *Urano-tænia*, *Deinocerites*, etc.

III. SABETHINÆ. Defined by the presence of hairs on the metanotum; the palpi are generally short in both sexes. The larvae never have the median ventral brush or rudder on the last segment, nor any pecten on the air tube in the species known. The air tube is long. The larvae live in small bodies of water confined usually in parts of plants, such as the leaves of the pitcher plant, leaves of *Bromelias*, flower sheaths of *Canna*, cocoanut shells and cacao husks, sometimes with surprisingly little water. A majority of the species inhabit the moist tropical regions.

Contains the genera *Sabethes*, *Sabethoides*, *Wyeomyia*, *Dendromyia*, *Joblotia*, *Phoniomyia*, etc.

HARRISON G. DYAR.

#### THE QUESTION OF TAX-FREE ALCOHOL.

At various times during the last fifteen years attempts have been made to secure legislation providing for the sale of alcohol for technical and other industrial uses free from the revenue tax. These attempts have resulted in failure and this country, in consequence, is practically prevented from developing certain important industries. In Germany and France, tax-free alcohol is used in enormous quantities for manufacturing purposes and is even employed as a fuel. The alcohol so employed must be 'denatured' or treated with some substance to render it unfit for drinking.

A few years ago the 'Committee of Manufacturers formed to assist in securing cheaper Alcohol for Industrial Purposes' was organized and has been very active in educating the public as to the advantages of cheap alcohol, and also in the direction of suggesting legislation at Washington. This committee is now favoring the passage of the bill recently in-

roduced in the House of Representatives by Mr. Calderhead, which provides that no internal revenue tax shall be levied on ethyl alcohol of domestic production which has been rendered undrinkable or unfit for use as a beverage, prior to withdrawal from distillery bonded warehouse.

As chemists are naturally and properly interested in the alcohol question, a committee was appointed nearly two years ago by the American Chemical Society to cooperate in every legitimate way with the Committee of Manufacturers in securing the desired end. This committee of the Chemical Society consists of Ira Remsen, H. W. Wiley and J. H. Long. At the recent New Orleans meeting of Section C of the American Association for the Advancement of Science and the Chemical Society, in joint session, a brief report of progress was made by Mr. Long, chairman of the committee. This report called out a very lively discussion, following which Section C appointed the same committee to bring in certain resolutions at the next session. The resolutions when read were adopted unanimously by the chemists present. They are as follows:

In view of the fact that alcohol enters largely into the production of many articles of common use and that the development of certain industries depends directly on the cost of alcohol,

And in view of the further fact that in the United States there is no provision for the sale of tax-free alcohol for manufacturing purposes and that consequently many of our manufacturers of chemical products work under a serious disadvantage as compared with the manufacturers of Germany, France and England, where the laws permit the sale of tax-free alcohol for use in the arts and industries,

And in view of the further fact that the use of cheap alcohol in this way would stimulate enormously many industries in the United States, and benefit the farmer, the chemical manufacturer and the ordinary consumer,

Be it resolved by this section of the American Association for the Advancement of Science that we heartily endorse the efforts

of the Committee of Manufacturers, which was formed to assist in securing cheaper alcohol for industrial purposes, in their work in urging the passage of an act through congress providing for the sale of tax-free alcohol under proper restrictions, and that we recommend that the widest publicity be given to this expression of our views through publication in the daily press, in the *Journal of the American Chemical Society* and in SCIENCE.

The literature sent out by the Committee of Manufacturers shows the many uses of tax-free alcohol in European countries and the directions in which it would be most valuable if available in the United States. This literature may be obtained from the chairman, Mr. Henry Dalley, 21 William Street, New York.

J. H. LONG.

**THE ANDREW CARNEGIE RESEARCH SCHOLARSHIP.**

A research scholarship or scholarships, of such value as may appear expedient to the council of the Iron and Steel Institute from time to time, founded by Mr. Andrew Carnegie (past-president), who has presented to the Iron and Steel Institute eighty-nine one-thousand dollar 5 per cent. debenture bonds for the purpose, will be awarded annually, irrespective of sex or nationality, on the recommendation of the council of the institute. Candidates, who must be under thirty-five years of age, must apply on a special form before the end of February to the secretary of the institute.

The object of this scheme of scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school or works, provided it be properly equipped for the prosecution of metallurgical investigations.

The appointment to a scholarship shall be for one year, but the council may at their discretion renew the scholarship for a further

period instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a paper to be submitted to the annual general meeting of members, and if the council consider the paper to be of sufficient merit, the Andrew Carnegie gold medal shall be awarded to its author. Should the paper in any year not be of sufficient merit, the medal will not be awarded in that year.

BENNETT H. BROUH,  
*Secretary.*

28 VICTORIA STREET, LONDON.

**SCHOLARSHIPS AND FELLOWSHIPS OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH.**

THE Rockefeller Institute for Medical Research purposes to award for the year 1906-1907 a limited number of scholarships and fellowships for work to be carried on in the laboratories of the Institute in New York City, under the following conditions:

"The scholarships and fellowships will be granted to assist investigations in experimental pathology, bacteriology, medical zoology, physiology and pharmacology, and physiological and pathological chemistry.

"They are open to men and women who are properly qualified to undertake research work in any of the above mentioned subjects and are granted for one year.

"The value of these scholarships and fellowships ranges from six hundred to one thousand dollars.

"It is expected that holders of the scholarships and fellowships will devote their entire time to research.

"Applications accompanied by proper credentials should be in the hands of the secretary of the Rockefeller Institute not later than April 1, 1906. The announcement of the appointment is made about May 15. The term of service begins preferably on October 1, but, by special arrangement, may be begun at another time."

L. EMMET HOLT,  
*Secretary.*

14 WEST 55TH STREET,  
NEW YORK CITY.

## THE AMERICAN PHILOSOPHICAL SOCIETY.

THE American Philosophical Society will celebrate, at Philadelphia, from April 17 to 20, the two hundredth anniversary of the birth of Benjamin Franklin. The program is as follows:

*Tuesday, April 17.*—8 P.M.: Meeting for reception of delegates and of addresses.

*Wednesday, April 18.*—10 A.M. and 2 P.M.: General meeting for presentation of papers on subjects of science. 8 P.M.: Addresses—‘Franklin’s Researches in Electricity,’ by Edward L. Nichols, Ph.D.; ‘Modern Theories of Electricity and their relation to the Franklinian Theory,’ by Ernest Rutherford, D.Sc., F.R.S.

*Thursday, April 19.*—11 A.M.: Conferring of honorary degrees by the University of Pennsylvania. 3 P.M.: Ceremonies at the grave of Franklin. 9 P.M.: General reception.

*Friday, April 20.*—11 A.M.: Addresses on Franklin as—‘Citizen and Philanthropist,’ by Horace Howard Furness, Litt.D.; ‘Printer and Philosopher,’ by Charles William Eliot, LL.D.; ‘Statesman and Diplomatist,’ by Joseph Hodges Choate, LL.D., D.C.L. 7 P.M.: Banquet.

## SCIENTIFIC NOTES AND NEWS.

DR. EWALD HERING, professor of physiology at Leipzig, has been made a corresponding member of the Academy of Sciences at St. Petersburg.

It is proposed to invite Mr. John Sargent to paint a portrait of President James B. Angell, to be placed in the Michigan Union Club House, shortly to be erected. The portrait will be a gift from the faculty, alumni and students of the university.

SIR PHILIP MAGNUS, superintendent of the Department of Technology of the City and Guilds of London Institute, has been elected member of parliament from London University, defeating by a small majority Sir Michael Foster, professor of physiology at Cambridge from 1883 to 1903.

BARON GUERNE has been elected president of the Paris Geographical Society.

DR. W. SCHEIBNER, professor of mathematics at Leipzig, celebrated, on January 8, his eightieth birthday.

THERE was an error made in a recent number of SCIENCE in regard to the presidency of the Geological Society of America. The officers of the society for the ensuing year are as follows:

*President*—Israel C. Russell, Ann Arbor, Mich.

*Vice-Presidents*—W. M. Davis, Harvard University; E. A. Smith, University, Ala.

*Secretary*—H. L. Fairchild, University of Rochester.

*Treasurer*—I. C. White, Morgantown, W. Va.

*Editor*—J. Stanley-Brown, New York City.

*Librarian*—H. P. Cushing, Western Reserve University.

*Councilors*—H. M. Ami, Canadian Geological Survey; J. M. Clarke, Albany, N. Y.; J. F. Kemp, Columbia University; A. C. Lane, Lansing, Mich.; G. P. Merrill, U. S. National Museum; David White, Washington, D. C.

LEAVE of absence for next year has been granted to Professor F. P. Whitman, of the department of physics of Western Reserve University.

A LETTER has been received at Stanford University from Dr. D. H. Campbell, written just as he was leaving Rangoon, Burmah, for Mandalay. He was to sail shortly from there for the Royal Botanical Gardens at Peradenya, Ceylon.

PROFESSOR FREDERICK STARR, of the University of Chicago, who set out for Central Africa last September to study the Pygmies, has entered the jungles as appears from a letter mailed on December 17, at Leopoldville, which is 1,200 miles inland from the east coast.

MR. WALTER WELLMAN has signed a contract with M. Godard, of Paris, for the construction of an airship, in which he will try to reach the north pole. It will weigh 750 pounds and have three motors, respectively of 50, 25 and 5 horsepower.

THE Duke of Abruzzi (Prince Amadeo of Savoy-Aosta), a cousin of King Victor Emmanuel, has almost completed arrangements for a voyage of exploration into the heart of Africa. The duke, who will start early in the spring, has been assured that the British and French government officials in Africa will assist him in every possible manner.

THE U. S. government has commissioned President David Starr Jordan, of Stanford University, and Professor Charles H. Gilbert, head of the department of zoology, to conduct an investigation of the fish and fisheries of Japan and the Island of Sakhalin during the coming summer. Professors J. O. Snyder and Harold Heath, of Stanford University, and Professor H. H. Torrey, of the University of California, will also accompany the expedition.

PROFESSOR P. H. ROLFS left the Subtropical Laboratory at Miami, Fla., on January 31, being succeeded as pathologist in charge by Dr. Ernst A. Bessey. Professor Rolfs began on February 1 his duties as director and horticulturist of the Florida Experiment Station at Lake City.

DR. H. E. PATTEN, instructor in physical chemistry in the University of Wisconsin, has accepted a position in the Bureau of Soils, Washington.

DR. FRITZ ZERBAN has returned from the University of Berlin to take up the Carnegie research assistantship to Professor Baskerville, in the place of Dr. Leo. F. Guttmann, who has been appointed tutor in physical chemistry at the College of the City of New York.

PROFESSOR KOCH is said to have decided to apply the Nobel prize recently awarded to him to the publication of a complete edition of his scientific writings.

THE seventh lecture in the Harvey Society course will be delivered by Professor Frederic S. Lee, of Columbia University, at the New York Academy of Medicine, on February 3, at 8:30 P.M., his subject being 'Fatigue.'

Professor W. B. Scott, of Princeton University, was announced to lecture, on February 7, before the Geographical Society of Philadelphia, on 'The Geology of South Africa, Notes of a Journey from Cape Town to the Falls of the Zambesi.'

DR. FREDERICK V. COVILLE, curator of the National Herbarium and botanist of the U. S. Department of Agriculture, Washington, D. C., gave, before the Philadelphia College of

Pharmacy, on February 2, a lecture on 'The Uses of Plants by the American Indians,' which was illustrated with a number of lantern slides.

CHARLES A. SCOTT, of the United States Forest Service, manager of the Dismal River Forest Reserve, has just completed a course of lectures on practical problems in forestry before the students in the forestry courses of the University of Nebraska.

THE death is announced of Dr. Karl von Fritsch, professor of geology and paleontology in the University of Halle.

IT is proposed to place a bust of the late Dr. E. Ziegler in the pathological laboratory of the University of Freiburg.

*The Journal of The American Medical Association* states that a large oil painting of John Morgan, founder of the medical school of the University of Pennsylvania, has just been added to the collection of portraits owned by the university and will occupy a position on the walls of Houston Hall. The portrait is the gift of the Hon. David T. Watson, Pittsburgh, who is a descendant of John Morgan. The tablet fastened to the frame is inscribed as follows: "Dr. John Morgan, born 1735, died 1789. Copy of original by Angelica Kauffman, in Rome, 1763-64." Dr. Morgan was born in Philadelphia in 1735, and was graduated in 1757 with the first class of the College of Philadelphia, which later became the University of Pennsylvania. He subsequently studied medicine in Philadelphia, later in Edinburgh, Paris and Padua, obtaining his professional degree from Edinburgh in 1763. He became the first teacher of medicine in the College of Philadelphia, and with William Shippen organized the medical school of the University of Pennsylvania. He was one of the early members of the American Philosophical Society, and also the first general director of the medical service of the continental army.

A MEETING of the committee of the International Association of Academies will be held at Vienna on May 30, 1906.

THE department of zoology of the University of California announces a series of twelve illustrated lectures by members of the department on the problems of marine biology, to which the public is cordially invited. The lectures will be based in part upon the work of the Marine Biological Station at San Diego.

THE Philippine wood collection of the American Museum of Natural History has been removed to the corridor on the ground floor leading from the north wing to the engine room, where it will be installed in a manner to show to the best advantage the beautiful grains and colors of the specimens. This collection is the most complete that ever has been made, and it represents all the woods of the Philippines which are valuable for manufacturing purposes.

WE learn from the *British Medical Journal* that an exposition of inventions, appliances, and other objects connected with hygiene, personal and public, will take place under the patronage of the Archduke Leopold Salvator in Vienna in March and April, 1906. Among the members of the honorary committee are Professor von Esmarch, of Kiel; Professors von Leyden and Rubner of Berlin; Professors Freiherr von Eiselberg, Schauta, von Stoffella, Benedikt and von Wagner, of Vienna; Dr. Neumayer, deputy burgomaster, Staff-Surgeon-General Professor Kratschmer and Professor Schattenfroh, president of the Vienna Institute of Hygiene.

THE annual general meeting of the Entomological Society of London was held on January 17, at the rooms of the society, 11 Chandos-street, Cavendish-square. The report showed that, for the first time in the society's history, the number of ordinary fellows had reached 500. The officers and council were elected for the session 1906-7 as follows: *President*, Mr. F. Merrifield; *hon. treasurer*, Mr. A. H. Jones; *hon. secretaries*, Mr. H. Rowland-Brown and Commander J. J. Walker, R.N.; *librarian*, Mr. G. C. Champion, F.Z.S.; *other members of the council*, Mr. G. J. Arrow, Mr. A. J. Chitty, Mr. J. E. Colin, Dr. F. A. Dixey, Mr. H. Goss, Mr. W. J. Kaye, Mr. H. J. Lucas, Professor E. B. Poulton, F.R.S., Mr. L. B. Prout, Mr. E.

Saunders, F.R.S., Mr. R. S. Standen and Mr. C. O. Waterhouse.

WE learn from the *Scottish Geographical Magazine* that Mr. Henryk Arctowski, late of the Belgian Antarctic Expedition, is engaged in developing a scheme for the international exploration of the South Pole. He proposes to begin the systematic exploration of the Antarctic regions by a preliminary circum-polar expedition, which is to be organized in Belgium, and is to leave Antwerp next autumn with the object of exploring the most unknown portions of the Antarctic in the hope of finding new lands and suitable places for the establishment of winter stations. These would be utilized by future expeditions, the intention being to establish a series of scientific stations in South Polar regions. Mr. Arctowski proposes to utilize an automobile of special construction to penetrate the interior of the Antarctic continent. If the experiment proves a success, it might be possible to set up a station far within the continent, whose scientific data would add greatly to the value of the observations made at the other stations which it is proposed to establish.

It is stated in *Nature* that at Christiania, on December 29, 1905, there gathered together under the presidency of Mr. John Sebelien a number of men interested in questions of agriculture and scientific subjects to celebrate the acquisition of national independence in the past year. A fund was opened for the purpose of fostering research in the subject of Norwegian agriculture, to which fund all Norwegians, both at home and abroad, are invited to subscribe. When the sum of \$4,000 has been subscribed, it is proposed to invite prize essays on particular questions, and to reward Norwegian scientific work in certain branches of learning; and later still it is intended financially to aid research work in agricultural science directly.

CONSUL KEENE, of Geneva, reports that the opening of the Simplon Tunnel, which was fixed for April 1, has been postponed to May, by action of the Swiss authorities. He says: "The official opening of the new international

line through the Simplon Tunnel, after having been advertised for April 1, 1906, is now reported as being postponed until May 1. After having been for a considerable time under discussion, the mode of traction between Brigue and Domo d'Ossola—*i. e.*, on 40 kilometers (about 25 miles)—is reported to be electrical, in accordance with a decision recently made by the Federal Department of Swiss railroads. The Swiss system of traction now in use on the railroad Berthoud-Thoune, in the Canton of Berne, will be applied with up-to-date improvements on the Simplon line. The first two electrical engines, when delivered at the end of the year, will first be tried on the Italian electrical lines of the Valteline. Electrical traction on Swiss railroads is a new thing; but it seems only natural that Switzerland, so rich in 'white coal,' begins to utilize its wealth of water, and supersedes, by the power derived from it, the enormous quantity of coal imported from Germany, France, Belgium and England. This new trial of electrical power on such an important new line will be watched with keen interest. If successful, the new mode of traction will certainly be employed all over the country, and there may be openings for our manufacturers at home in that line."

*The Journal of the American Medical Association* states that the German national committee in charge of arrangements for the approaching International Medical Congress, to be held at Lisbon in April, will present the following two proposals at the Lisbon congress and urge their adoption: "1. The organization of an international bureau for the general medical congresses, which will act during the intervals between the congresses. The members of the bureau to be the presidents of the past and approaching congresses and the members of all the national committees. This central office should have its headquarters in Paris, and its task will be to preserve continuity and order in the arrangements of the congresses, especially in the making out of the programs, regulating the sections, appointing topics for discussion and selecting speakers to present the various themes, and the

honorary presidents, working always in co-operation with the committee of organization of the congress. Motive: The need for some international body to serve as a court of appeal in matters affecting these international congresses has long made itself felt, to prevent or smooth away differences that may arise between the committee of organization and the representatives of the special sciences. At the same time, such an international body would serve by regulating the relations between the great general congresses and the international specialist congresses, and also with the medical congresses in the different countries. 2. The general international medical congresses should be held not oftener than once in five years. Motive: It is generally acknowledged that the international congresses have lost in prestige of late years. This is due principally to the brief interval between them. In case they occurred only once in five years the preparations for them would probably be more carefully made, and more energy would be devoted to the solving of scientific problems, these forces now being drained away by their being called on so constantly for scientific gatherings of such kinds. Besides this, if the international congresses were not held so frequently, it would be easier to find suitable places at which to hold them." Waldeyer and Posner are chiefly responsible for the drafting of these resolutions. They are to be submitted to the various national committees for discussion in the hope that something tangible will result in the way of the desired reforms.

#### UNIVERSITY AND EDUCATIONAL NEWS.

At the midyear meeting of the board of trustees of Syracuse University, Chancellor Day reported an increase in attendance at the university of 325 over last year, and the purchase of the Renwick 'castle.' Plans for a men's dormitory on College Place, to cost \$100,000, were accepted. It was also decided to expend \$100,000 for the erection of a new chemical laboratory. The board decided that the 'castle' be converted into a college of pedagogy.

PRESIDENT JAMES, of the University of Illinois, announces the establishment at Urbana of a new school of railway engineering. It will be opened for work next September. The school will have three departments, intended to cover the entire range of railway work. Aside from the faculty in the various departments, prominent railway officials will give special courses to emphasize the value and the practical features of the curriculum.

AT the annual meeting of the Pennsylvania State Board of Agriculture, on January 24, public announcement was made of a change in the organization of the agricultural work of the Pennsylvania State College which, it is understood, has been in contemplation for some time. The investigations in animal nutrition with the respiration calorimeter which have been carried on by the Experiment Station for the past seven years in cooperation with the U. S. Department of Agriculture are, under the new arrangement, to constitute a separate department of the college, to be called the Institute of Animal Nutrition. Dr. H. P. Armsby is to be the director of the new department and is to be relieved of executive duties so as to enable him to devote his entire time to this special line of work. The duties of the director of the Experiment Station and of dean of the School of Agriculture are to be combined and the dual position filled by a new appointment, which, it is expected, will be announced in the near future.

THE recently completed Agricultural Hall of the University of Nebraska was formally dedicated on January 23, 1906. The principal address was given by the Honorable William G. Whitmore, regent of the university. The building is of gray brick construction, with solid oak finishing internally. It contains the agricultural library, an auditorium, and class rooms and laboratories for most of the departments in the University School of Agriculture. The administration building is nearing completion. Its construction is of plain brick with ornamental terra cotta finish. It is to contain the offices of the chancellor, deans of the colleges, university registrar, treasurer,

secretary, superintendent of grounds and buildings, etc.

THE new administration building of the University of California, for which the last legislature made an appropriation of \$250,000, has been dedicated with addresses by President Wheeler, Governor Pardee and others.

THE entire main building (including the library and the physical and chemical laboratories) of the Fifth District Agricultural School of Alabama, was destroyed by fire on January 5. Nearly all the laboratory apparatus and the Experiment Station library were saved. The academic operations are continued as before in other quarters. The loss is about half covered by insurance.

THE position of research assistant in serum pathology in Indiana University for 1906-1907 is open for applicants. Candidates must have completed at least two years' work in a medical school of high grade, and must have a fair knowledge of bacteriology, of general pathology and of volumetric and gravimetric methods of quantitative chemistry. Preference will be given a medical graduate. Address: Department of Pathology and Bacteriology, Indiana University, Bloomington, Indiana.

ABRAM W. HARRIS, president of the Jacob Tome Institute, Port Deposit, Md., has been elected president of Northwestern University, to succeed Dr. Edmund Janes James, now of the University of Illinois.

THE president of the board of education has appointed Professor W. W. Watts, M.A., F.R.S., of Birmingham University, to the professorship of geology, at the Royal College of Science, South Kensington, vacant by the retirement of Professor Judd.

THE council of King's College, London, has elected Mr. Harold A. Wilson, D.Sc., M.A. (Cambridge), as professor of physics in succession to Professor W. A. Adams, M.A., D.Sc., F.R.S.

DR. F. HIMSTEDT, professor of physics, has been elected prorektor of the University of Freiburg.